

**PRELIMINARY PLANT ASSOCIATIONS OF THE  
SOUTHERN OREGON CASCADE MOUNTAIN PROVINCE**

**By**

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Ultimately, any blame for this classification is ours. We hope that it is helpful to the land managers we serve. Its intended to provide an anchor point for management, and hopefully stimulate thought.

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# INTRODUCTION

## SCOPE

This is the preliminary classification of the vegetation in the southern Oregon Cascades into plant associations. It applies to the Umpqua National Forest and the Cascade side of the Rogue River National Forest. It is for interim use and user review. It will be superseded by a final guide which will incorporate user suggestions and management experience. We invite you to note needed improvements and to provide feedback on its accuracy and utility.

The basis for the classification is 543 sample plots taken on Forest Service administered lands and correlation with classifications throughout the northwest. The emphasis is on terrestrial, forested systems. Only a few "meadow" and riparian samples were measured. The keys, descriptions, and discussions will apply to those lands sampled; use on other lands may not be applicable.

## PURPOSE

The primary purpose of the classification is to provide organized and reliable plant response information for use in project level work and resource planning. The classes (plant associations) represent the project level of a land classification hierarchy and are based on plant species present, geology, soils, terrain, topographic features, and plant response to management activities.

The principle user will be field personnel who need to know how a species or group of species will respond to a specific set of environmental conditions or management activities. Some discussions on various management activities are included for each plant association.

## DEFINITIONS

CLIMAX is the point in succession when plant composition and structure does not appreciably change, respiration is approximately the same level as photosynthesis, and the accumulation of

biomass is small or negative. It is a theoretical concept and mainly used as a reference point in succession.

POTENTIAL NATURAL VEGETATION is a term often used as a reference point in order to avoid the problems associated with the climax concept. Most of the southwestern Oregon area has not reached CLIMAX status and it is often difficult to predict what species composition and structure will be, if the stand were to remain undisturbed long enough to reach CLIMAX status. Instead of worrying about what climax stands may look like, we use stands from 100 to 300 years old as a reference point in this publication. We feel stands of such age are stable enough to reveal their potential species composition, structure and give some information on biomass production.

An ASSOCIATION is the lowest level (project level) of the classification hierarchy. Plant response within an ASSOCIATION is expected to be consistent. Plant response between ASSOCIATIONS is expected to be significantly different. ASSOCIATIONS are intended to have project level resolution for project level use. An ASSOCIATION is often named after the CLIMAX species of the tree, shrub and/or herb layers.

A SERIES is an aggregation of plant ASSOCIATIONS named after the same CLIMAX dominant. For example the Douglas-fir / Oceanspray ASSOCIATION and the Douglas-fir / Dwarf Oregongrape ASSOCIATION both belong to the Douglas-fir SERIES. Some management considerations can not be aggregated upward in the hierarchy from the ASSOCIATION to the SERIES. In most cases plant response within a SERIES is more similar than between SERIES.

## CONCEPTS

Associations are based on presence and abundance (percent cover) of species, and site variables such as slope, aspect, elevation, soil depth, tree productivity, topographical position and geology.

Species presence and abundance result from environmental gradients, the process of classification attempts to find natural breaks in the gradient to assign classes. For example, north slopes are often different enough vegetationally from south slopes that each are different plant associations. This type of natural break is easily recognized and delineated. On the other hand, plant associations often change from the top of the slope to the bottom, but the change is so gradual, that a boundary is difficult to find. Consequently, in complex areas such as southwestern Oregon where environmental gradients are gradual, boundaries between associations can be interfingered and keying to association can be difficult. In fact, based on actual field use, we expect the key to be successful (in determining the

plant association) on approximately eight of ten sites.

**Because the associations are statistical descriptions based upon sample plots, it is important to remember they will not often exactly describe a particular site. Experience in using the key and guide is essential to proper field application.**

We sampled the oldest and most stable stands we could find, in order to determine the site's potential, i.e., its productivity, composition, and structure. This sampling strategy is necessary to establish a base, but makes the classification more difficult to use on a disturbed or harvested site. If your work requires keying such sites, see the section on using keys on disturbed sites.

## HOW TO USE THIS GUIDE

### USING THE KEYS

There are two levels of keys, the series key and the association keys. The series key differentiates between different climax dominants. Within each series, association keys differentiate associations.

The key is only a tool to make the classification useable. It is not the classification. Consequently, it may be difficult to key some sites. Following the steps below will minimize keying problems.

*Select a uniform site.* If the area is not uniform, i.e., it has both north and south slopes or it has two parent material types, stratify and key both areas or identify the most extensive area and key it. You may be dealing with two or more associations for some management prescriptions. Consider each separately.

*Select a representative site.* Select your sites for keying after you have seen the entire area. If it's mostly basalt, key a basaltic site. If the area significantly varies, consider stratifying; particularly if the association response may be significantly different.

*Make a species list.* List the most abundant and common species on the site and estimate their cover ocularly by mentally dividing a fifth acre plot into quarters, eighths, etc. For example, if rhododendron cover could fill about 1/4 of the plot, it averages about 25 percent cover.

*Use the key sequentially.* Always start at the beginning with the series key and note that the clues in the alternatives (dichotomies) are given in order of importance. The first is most important. Always read both dichotomies before choosing an alternative. From the series key, work through the association keys.

*Make a tentative identification.* After you arrive at an association name in the key, read the description to see if it fits the site. If not, return to the first point in the key that was troublesome and take the other dichotomy. Check the new association and compare it with your first answer and the site. More detailed tables are given for each association and

will help determine the final selection. Also remember that there will be sites that simply do not fit the key or the classification.

*Select the appropriate association.* The choice should fit the ground. If it does not, please let us know. Feedback is the only way to improve the final guide.

### KEYING DISTURBED SITES

Although the association key was constructed to identify stable vegetation, i.e., stands of 200 years or older, users have expressed a need to identify the association on a recently harvested site. Seral stages will be described in the final guide, but until then, follow this suggested procedure.

*Select an area to key.* As described earlier, select uniform, representative sites. If you are keying to identify associations with reforestation difficulties, key the area that you perceive to be the most difficult to reforest; that way the prescription will succeed for the entire unit. Be sure that the area is of great enough proportion to warrant increased effort and resources.

*Find undisturbed or minimally disturbed vegetation.* To find plants that characterize the site (key plants), use islands of undisturbed vegetation. If all areas have been disturbed, use the area with the least disturbance. Research in southwestern Oregon indicates that areas that have been clearcut and burned still have about 65 percent of the original species present within two years after burning, but with greatly reduced cover. After about five years, sprouters and pioneers will dominate. If the site has been cut, burned, and scarified, look for "key" plants around stumps.

*Check adjacent stand with the same site characteristics.* Adjacent stands can be used to check your decisions and in some cases to key the harvested site. If you are attempting the latter, be sure that the adjacent stand is on the same aspect, slope, parent material, soil, etc.

*Read association descriptions.* You should already be in the habit of reading the association description to help make your final choice. There are priorities (similar to those identified in "How to Use Indicators" below) to follow in this process. Understory concurrence is most important. That is, the list of understory species present should match the association description quite well (but not necessarily perfectly). Be sure to check the constancy table at the end of the association description for the complete species list. Next, the environmental description and shrub composition should match. Herbaceous species are often of some help but the "general description" contained in the herb list is not often much help.

*Experience with the area.* Experience over the range of conditions is most useful. It may be very difficult for a newcomer to key in the Cascade Mountain Province. When possible get help from personnel who have had experience using the key, or the authors.

## HOW TO USE INDICATORS

These six concepts for using indicators are interrelated and should be considered together. If they are used separately, we suggest the hierarchy in which they appear. At this time, their use is an art. In the final guide, we plan to use regression analysis to make their use more of a science.

Indicators which seem to conflict are often found during site evaluation. By using all the concepts, those which are most representative of the site can be determined.

*Number of plants.* Shakespeare once said "one plant does not an indicator make (*sic*).<sup>2</sup>" Consequently one poison oak plant does not automatically mean the site is dry and that regeneration will be a problem.

*Absolute cover.* In most instances, 20 percent cover of poison oak is a better indicator of hot surface soils than is 10 percent cover. However, it does not mean that the soil condition is twice as severe.

*Correspondence.* Look for corresponding indicators, whether plant or environmental. Hairy honeysuckle and poison oak are both indicators of hot dry conditions, for instance. If both occur, they strengthen the interpretation and errors are less likely. Shallow soil and high coarse fragment content may also be found on these sites. Consequently, the environmental conditions "correspond" with the plant indicators.

*Spatial distribution.* If the indicator used is bunched in one corner of the area being evaluated (not evenly distributed) it is not indicative of the site; rather stratify the site or accept the included variation. An indicator should be well distributed. Herbs, because of their size, often are only indicators of a microsite. Beware, however, of sensitive herbs which can indicate more general conditions.

*Temporal distribution.* As a general rule, longer-lived species are better indicators of the environment. Trees, for example, must more frequent and a broader range of extremes and therefore are more indicative of species which are appropriate for regeneration. Annuals, at the other extreme, are dependent only on the conditions existing during one growing season or cycle and are not indicative of long-term conditions.

*Sensitivity.* Some species are more sensitive than others. Douglas-fir, for example, will grow anywhere; as will rattlesnake plantain. But others are restricted and make good indicators. *Darlingtonia*, for example, is totally restricted to sites with running water; if the running water was not obvious, *Darlingtonia* would be a good indicator of running water.

## USING THE ASSOCIATION DESCRIPTIONS

The following is a template of the plant association descriptions. It explains the types of information that can be found in each section and how it will be

formatted. (The number and species displayed here are fictitious and are included only as examples.)

At the top of the first page of each association description are three separate naming conventions.

### COMMON NAME *Scientific Name* CODE

**EXTENT:** A description of where the plant association may be found is given here. The description is usually by Ranger District within the Cascade Mountains of southwestern Oregon (Umpqua and eastern half of the Rogue River National Forests). "N = 6" identifies the number of plots used in the quantitative description of the association.

**IDENTIFYING CHARACTERISTICS:** The specific characteristics that make this association distinct from other associations will be emphasized in this section. The "other" associations that are selected for comparison are those which may be keyed to because of a difficult or erroneous decision made while using the keys. Often this section may cause the user to review a different association in more detail. Associations from other adjacent classifications are also compared.

**ABIOTIC ENVIRONMENT:** The means and standard deviations presented here are developed from plot data. Elevation, aspect, and slope are simple topographic features which assist in describing the association relative to the landscape. The aspect statistics are computed on a circular basis. Total soil depth is the distance from the soil surface to bedrock; rooting depth describes the zone above which contains approximately 90 percent of all root penetration. Soils were often excavated to a maximum depth of 50 inches, thereby skewing the mean and standard deviation values to some degree.

Although basal area is not an abiotic factor, it is included here as a matter of convenience. Total basal area, as presented, is a pure basal area. This is an attempt to give some value to overall biomass productivity, albeit a poor attempt. All vegetation was included, even shrubby hardwoods (e.g.,

maples) and Pacific rhododendron, on an extreme occasion.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4904.0	566.0
Aspect (deg)	216.1	111.4
Slope (%)	24.3	19.0
Total soil depth (in)	39.7	12.4
Rooting depth (in)	47.1	6.7
Total basal area (ft <sup>2</sup> /ac)	322.1	92.8

**CLIMATE:** The temperature is based on elevation modified by slope and aspect and local records (Smith 1988). Mean annual temperature is the average of temperatures over the year. Maximum monthly temperature is an average of the highs for the hottest month, usually July or August. The precipitation values are based on isohyetal maps by McNabb, et al. (1982) and Froehlich, et al. (1982). Mean annual precipitation includes the water equivalency of any snowfall. Dry season precipitation is defined by McNabb, et al. as that which occurs between May 1 and September 30.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.5	1.5
Maximum month temp (F)	75.0	2.3
Mean annual ppt (in)	53.4	13.0
Dry season ppt (in)	7.7	1.4

**FOREST FLOOR:** The characteristics of the forest floor are important considerations in evaluating erosion potential, fuel accumulation, and turn-over rates, and to some degree site potential. All covers were ocularly estimated and are the average per-

cent of the ground covered by each component. Moss is defined as the soil surface covered by mosses or lichens. Bareground is exposed soil composed of coarse fragments less than 1/16 inch in diameter. Gravel is surface covered with coarse fragments between 1/16 and 3 inches in diameter. Rock is the surface covered with coarse fragments greater than three inches in diameter. Bedrock is the bedrock exposed at the surface and considered immovable by erosional processes.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.8	5.9
Moss (%)	2.3	2.1
Bareground (%)	1.0	1.5
Gravel (%)	1.1	1.3
Rock (%)	2.4	2.5
Bedrock (%)	.1	.2

**VEGETATION:** This section includes a description and interpretation of the species listed in the constancy tables at the end of the association description. Environmental indicators, successional relationships, and individual species associations are possibly discussed.

**SILVICULTURE:** Comments in this section may include regeneration, survival, growth, harvest limitations, vegetation management, site preparation and thinning. Comments on regeneration appropriateness come from the overstory and understory species listed in the constancy table. Growth potential in terms of timber and biomass production is based on the total basal area per acre and the relative covers of overstory, understory, shrubs, herbs, and grasses listed in the constancy tables. Vegetation management recommendations and concerns are given. Comments about competition are based on observations and past silvicultural experiences, and are generally not from scientific studies. As more studies are done in this Province, the results will be included in future guides.

**WATERSHED MANAGEMENT:** Weather conditions, soils, vegetation, sensitivity to management and riparian concerns may be included in this section. Weather conditions are from the precipitation and temperatures estimates predicted for each plot. Estimates of average snow levels are based on heights of lichens on trees. Soil characteristics are

estimated from a combination of plot data and interpretations in the Soil Resource Inventories for the Rogue River and Umpqua National Forests. Refer to these for site specific information. Revegetation estimates are based on knowledge of the shrub and herb species ecology and the climate for the association.

**FIRE MANAGEMENT:** Weather conditions, fuels, decomposition rates, fire regimes, and physical and biological site characteristics may be discussed here. Weather information was taken from the precipitation and temperature estimates estimated for each plot. An estimate of how weather influenced the fire regime was made from knowledge of the weather patterns in the Cascade Province. Fuels estimates were taken from litter cover and visual observations. More detailed fuels information based on line-intercept transects will be included in the final guides. Disturbance types (such as fire, disease, insect, ice, snow, wind or man) were noted on each plot and, if possible, the number of years since the last detectable disturbance. This along with stand age was used to estimate the historic fire regime for the association.

**RANGE & WILDLIFE MANAGEMENT:** Forage, water sources, habitat structure and sensitive plants may be covered in this section. Forage for both domestic range and wildlife are estimated from shrub, herb and grass covers and local knowledge of the Province. Water sources are estimated from the number of intermittent and larger streams per kilometer within a kilometer diameter of the plot. Habitat structure was estimated ocularly. Sensitive plants were taken from the constancy tables and knowledge of the habitats in which they occur.

**RECREATION & VISUAL MANAGEMENT:** Slope, terrain, soils, vegetation, climate, and potential uses may be included in this section. Estimates of recreational use and visuals were made from information on environment and vegetation and knowledge of the Province.

**CONSTANCY TABLES:** These tables include a complete list of all vegetation sampled in the association. In the tables below, CONST is the percent constancy of the variable. For example, in the overstory section, species XXXXX occurred on 62% of the plots classified into this particular association. MEAN is the average percent cover for the plots on which the species occurred; in this case XXXXX had



an average ground cover of 16.0 percent with a standard deviation (S.D.) of 6.5 percent. In other words, approximately two-thirds of all XXXXX

species covers when it occurs in this association will be between 9.5 and 23.0 percent (16.5 +/- 6.5).

#### PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
XXXXX	Overstory tree species TOTAL OVERSTORY	62% 100%	16.0 16.0	6.5 6.5	remarks included as appropriate
XXXX	—CONIFERS— Understory species	12%	2.0	.0	
XXXX	—HARDWOODS— Understory species	12%	2.0	0	
	TOTAL UNDERSTORY	100%	3.0	.0	
XXXX	Shrub species TOTAL SHRUB	62% 100%	19.0 19.0	21.6 21.6	
XXXX	Herb species TOTAL HERB	12% 100%	1.0 1.0	.0 0	
XXXXX	Grass species TOTAL GRASS	12% 100%	2.0 .8	.0 1.4	

#### USING THE SERIES OVERVIEWS

The Series Overviews are similar to the Association descriptions. The constancy tables at the end of each Series Overview are slightly different from those included in the Association descriptions. Using the table below as an example, CONST is the same as described above. MIN and MAX are the minimum and maximum percent covers for each species in the Series, respectively. In this example,

rattlesnake plantain occurred on half (50 percent) of the plots classified into this series. The minimum and maximum covers of rattlesnake plantain where it was present was 1 percent and 10 percent, resulting in a RANGE of 9 percent (10 - 1 = 9). MEAN, S.D., and REMARKS are unchanged from the discussion of the Association Description above.

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
GOOB	Rattlesnake plantain	50%	1	10	9	6.5	4.4	

## THE SOUTHERN CASCADE SETTING

The Cascades range from Canada to Mt. Lassen in Northern California with substantial variation in climate. The study area encompasses the Umpqua National Forest and the eastern half of the Rogue River National Forest, from the Cottage Grove Ranger District in the north to the Ashland Ranger District on the south (Figure 1). Our southern climate differs significantly from that of the central Cascades of Oregon (Mt. Hood and Willamette National Forests). The transition from Temperate to Mediterranean climate occurs south of the Cottage Grove Ranger District, possibly the Calapooya Divide, and is gradual. The Ashland Ranger District, the southern most in latitude, still supports some elements of Temperate ecosystems. The relative lack of cloud cover and its influence on temperature and moisture extremes is the most significant difference in climate between the two climatic zones. High growing season temperatures, frequent frosts, high evaporative demand, limited precipitation, all somewhat related to the extent of marine influence are characteristic. The Siskiyou mountains, immediately west with peaks over 7,000 feet, block eastward flow and dampen the oceanic influence. The northern portion of the study area, near Cottage Grove, is more greatly influenced by easterly flow where low coastal mountains do not effectively block or dissipate marine influence.

The uniform north-south Cascade orientation and ever increasing elevation toward the east culminating in peaks above timberline, provide a rather predictable elevational banding of the vegetational gradient. Moreover, species richness varies with latitude, as the climate changes from cool, moist at the northern end of the area to a combination of environments at the south end.

Douglas-fir dominates the overstory of most stands. It is usually seral, replaced most often by western hemlock in the north or white fir in the south. Generally, late seral species are increasing, possibly a result of effective fire control. However, we tend to sample older, undisturbed stands. To evaluate relative trends across the southern Cascades, a more complete sample of seral stages would be required.

The subprovince descriptions offer more details on the Cascade setting.

### SUBPROVINCES

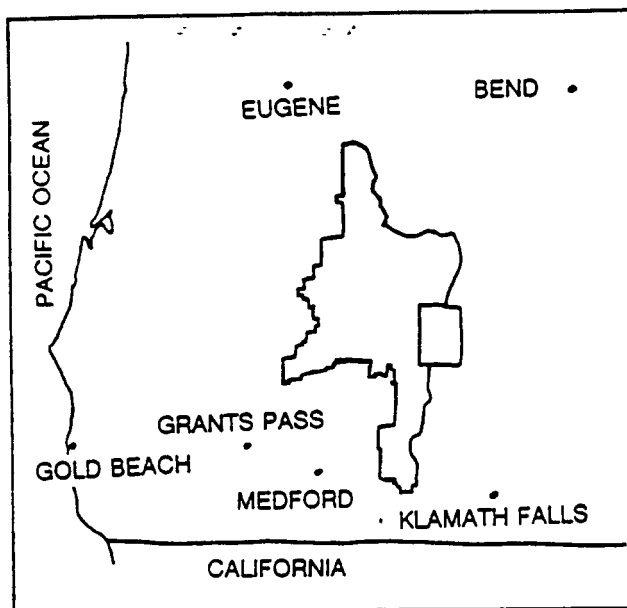
The environment in the southwestern Oregon Cascades changes sharply with latitude and longitude. Precipitation increases from west to east, while the age of the parent rock decreases. North-south differences in temperature, moisture, and the number of clear days and nights effect significant changes in vegetation production and composition.

Ecological and silvicultural interpretation would be aided by breaking the Province into subprovinces with similar environmental characteristics. Each subprovince can be associated with particular problems and opportunities, and follows major drainage boundaries, changes in geologic formations, and climate.

Latitudinally there are three major basins, the Willamette, Umpqua, and Rogue Rivers. The Calapooya divide marks the boundary between the Willamette and the Umpqua and the Rogue-Umpqua divide splits the remaining area to the south (see Figure 2). Longitudinally, geology serves as the dividing line. The Tiller Ranger District includes the Klamath Province, but the remainder of the area is either Western Cascade or High Cascade material (Baldwin 1964).

### WILLAMETTE SUBPROVINCE

The Willamette Subprovince contains the Cottage Grove Ranger District, the most northerly district of the Umpqua National Forest. It is part of the Western Cascade geological province including related basalts, andesites, and tuffs. Comparatively, the Subprovince has fertile soils. Slopes are steep and streams regularly dissect the terrain. Annual rainfall averages about 60 inches, including about 10 inches during the dry season (May through September), and summer evapotranspirational demand is dampened by frequent, summer, marine overcast. Temperatures are generally mild (May averages 55 degrees F., August averages 65 degrees F.) and cooling may be required 172 days per year. There are usually 153 days between spring and fall frosts. The environment favors western hemlock, at the



**LEGEND:**

PROVINCE BOUNDARY —————

NATIONAL FOREST BOUNDARY - - - -

RANGER DISTRICT BOUNDARY .....

RIVER ~~~~~

SCALE: 1" = 12.5 MILES

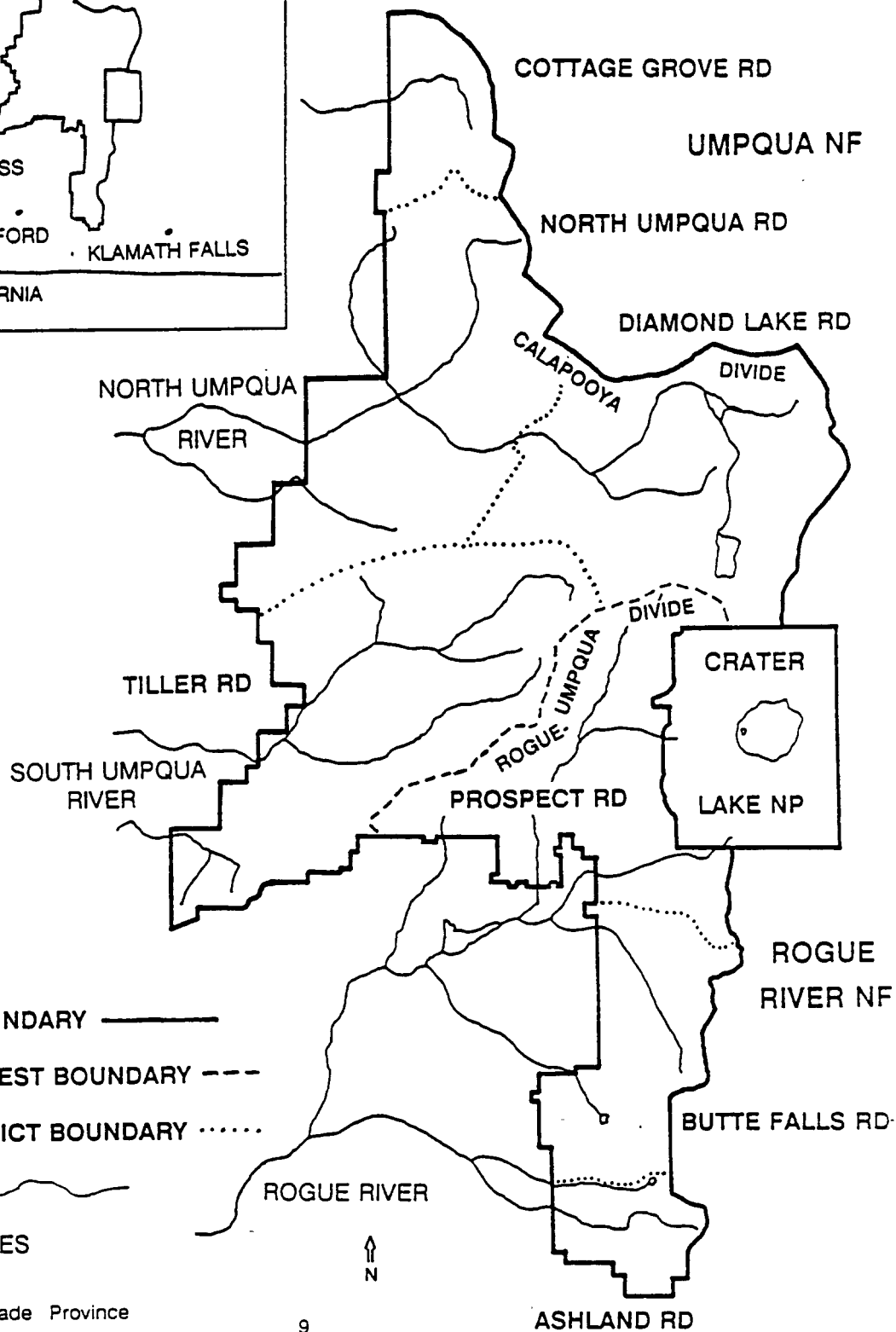


Figure 1. Map of the Cascade Province

# PRECIPITATION AND TEMPERATURE REGIMES OF THE SUBPROVINCES

	KLAMATH PROVINCE	WEST CASCADE PROVINCE	HIGH CASCADE PROVINCE
WILLAMETTE BASIN		PRECIPITATION Total - 60 in Dry season 10  TEMPERATURE May - 54.7 Aug - 64.5	
		Calapooya Divide	
UMPQUA BASIN	PRECIPITATION Total - 35 in Dry season 6	PRECIPITATION Total - 50 in Dry Season 8  TEMPERATURE May - 53.5 Aug - 61.9	PRECIPITATION Total - 60 in Dry season 9  TEMPERATURE May - 46.9 Aug - 58.8
		Rogue / Umpqua Divide	
ROGUE RIVER BASIN		PRECIPITATION Total - 40 in Dry Season 5  TEMPERATURE May - 53.3 Aug - 63.8	PRECIPITATION Total - 45 in Dry season 8  TEMPERATUE May - 40.4 Aug - 55.2

Figure 2. Precipitation and temperature regimes of the Subprovinces.

lower elevations, and silver fir at the higher elevations. The Silver Fir Series increases in importance northward. White fir, essentially absent, is supplanted by grand fir.

Biomass production is generally high for all species, conifers, hardwoods, and shrubs alike. Vegetation management can be a real challenge. The most limiting site resource may be either light (when the favored species is overtopped) or moisture. Maintaining a diversity of habitat structure is an important consideration. There are comparatively few meadows, brushfields, ponds, lakes, and species diversity is comparatively low.

## KLAMATH SUBPROVINCE

The Tillier Ranger District is the only district on the Umpqua National Forest which is influenced by the Klamath Geological Province. The Province fingers into the District on the southwest side, but the majority of the District is in the Western Cascade Geological Province. Parent rock types are varied as is the related soil fertility. Rainfall at the lower elevations can be as low as 35 inches annually, or as high as 70 inches near the taller peaks. Dry season precipitation is about 6 inches, but marine influence (influx of summer fog and a general dampening of temperature extremes) is not as great as it is in the Willamette Subprovince. Western hemlock and white fir co-occur, but western hemlock is dominant on a majority of sites. White fir associations are scattered on the drier sites where temperature extremes are more pronounced.

The Tillier Ranger District is the most geologically varied District on the Forest. Timber volume production is high on some sites and low on the ultrabasic sites. There is a variety of reforestation and vegetation management problems. Water deficit is an important consideration in reforestation and vegetation management, particularly in the White Fir Series. However, the diversity of species on most sites provides a number of management options. Species can be mixed to achieve a wide variety of integrated management goals.

## UMPQUA WESTERN CASCADE SUBPROVINCE

Including most of the North Umpqua Ranger District and a part of the Diamond Lake Ranger District of the Umpqua National Forest, this subprovince is dominated by basalts and andesites, although there are sites with ash, pumice, tuffs, or ash and pumice that have been moved and redeposited by streams. Annual rainfall averages about 50 inches annually with about 8 inches falling during the dry season. May temperature averages 54 degrees F.; August temperature averages 62 degrees F. Higher parts of the subprovince are often out of the influx of summer fog and temperature swings can be extreme. However, the protection of high cloud cover is not uncommon. On the average, there are 143 days between spring and fall frosts. The Western Hemlock Series dominates the landscape, but grades into a variety of series at the higher elevations.

Biomass productivity generally is high, but there are a number of shrubs that compete with the conifer crop for site resources. Rivers and associated resources are valuable, but much of the species and habitat diversity is associated with the outcrops of rock (only rarely granitic) that produce cliffs, shrubfields, and meadows. Species diversity is also high at mid to high elevations where the Western Hemlock Series interfingers with the Series related to higher elevations, such as the Silver Fir, Shasta Red Fir, Mountain Hemlock, and the White Fir Series.

## UMPQUA HIGH CASCADE SUBPROVINCE

The Umpqua High Cascade Subprovince occurs on the Diamond Lake Ranger District of the Umpqua National Forest. It includes the High Cascade Geological Province, the more recent basaltic and andesitic flows and extrusions and deposits of pumice and ash. Soil fertility varies accordingly. The basalt and andesite usually produce a deep, fertile soil, while the pumice and ash are most often young, shallow, and infertile. Terrain varies from dissected ridges to almost flat areas that retard air circulation and collect cold air. The subprovince receives about 60 inches of rain annually. About 9 inches fall during the dry season. The temperature is cool. May temperatures average 47 degrees F.; August temperatures average 59 degrees F. There are usually 85 days between the last spring and first fall frosts. Soil temperatures remain cold during the growing season and may limit biomass production. There are a

variety of Series present including Lodgepole Pine, Mountain Hemlock, White Fir, Pacific Silver Fir, Shasta Red Fir, and Western Hemlock.

The variety of structure (peaks, lakes, streams, meadows) in this subprovince provides a number of opportunities, however, there are some important limitations, for example, dealing with pumice and ash at high elevations.

Pumice and ash are size classes of ejected material, called pyroclastic rocks. They may be referred to as tuffs after they are redeposited by wind or water and compacted. Their composition is similar to glass, high in silica, potassium, and aluminum, and low in iron, magnesium, and calcium. As such they are infertile. Newly deposited material (Mazama ash) is non-consolidated, and highly erodable. Nutrient availability is dependent on the amount of organic matter consolidated within the profile. As organics accumulate, decompose, and become available to the plant, fertility increases and the rate of soil development increases. This process changes both the chemical composition and the physical structure and occurs from the top down. Physical changes affect the water regime and thermal properties. The increase in organic material and change in structure increases the water holding capacity. The presence of both water and organic matter favorably changes the thermal properties. Heat storage and transfer are increased. During the clear days common to southwestern Oregon, more heat is transferred away from the surface layers into the soil. At times, such transfer may keep surface temperatures below lethal levels and reduce transpiration. Additionally, the rooting zone temperature is increased. This change is important in flats where low soil temperatures may limit solution uptake. At night, heat stored in the soil is released into the cooler atmosphere. The heat offers some protection against frost and dampens the extremes in the seedling environment. The importance of organic matter cannot be overemphasized when dealing with pumice or ash.

Depth of the layer and size of the particles also affects physical and chemical properties. In many places the layer of ash/pumice is less than a foot and buries a fully developed soil. Management strategy and expected vegetation response would be significantly different than where deeper layers exist. Finer materials have a higher water holding

capacity. However, a significant proportion of plant available water may be held within the particles themselves. Retaining the organic materials and soil structure in ash/pumice soil will maintain site capability. Disturbance, such as burning, brushing, scarification, and piling, tend to reduce productivity.

Long-stolon sedge can seriously hinder reforestation efforts almost anywhere in the subprovince. Light surface disturbance stimulates the formation of dense mats. Breaking the mats during site preparation may stimulate even greater densities, and burning generally is ineffective. The best strategy is to identify the presence of long-stolon sedge and prescribe to avoid soil surface disturbance. Long-stolon sedge is often confused with Ross sedge, so correct identification is essential. In areas where the long-stolon sedge dominates, deep plowing may be required to introduce other vegetation.

## ROGUE WESTERN CASCADE SUB-PROVINCE

The Butte Falls and Prospect Ranger Districts include lands within the Rogue River Basin and the Western Cascade Geological Province. Although there is a variety of intrusive materials, basalt and andesite are the most common. Except for areas near fault zones with heavy clays, soils generally are productive. Terrain is moderately gentle. Annual rainfall averages about 40 inches, including 5 inches that fall during the dry season. May temperatures average 53 degrees F.; August temperatures average 64 degrees F. The average time between frosts is 151 days, but there are 239 days that may require cooling. Generally the environment favors the true firs over western hemlock, with the latter increasing in occurrence towards the north. White Fir is the most common Series. It grades into the Shasta Red Fir Series at the upper elevations and into the Douglas-fir and Ponderosa Pine Series at the lower elevations.

Moisture stress is a common problem in the subprovince in the drier associations of the White Fir Series and in most associations of the Douglas-fir Series. The Ponderosa Pine Series is moisture limited. Achieving survival of crop trees on south aspects may require careful planning.

## ROGUE HIGH CASCADE SUBPROVINCE

The Prospect, Butte Falls, and eastern part of the Ashland Ranger District of the Rogue River National Forest are partly in the High Cascade Geological Province. Parent rock types include basalts and andesite, but also include extensive areas covered with pumice and ash. Terrain is gentle, often flat. Cold air often puddles. Rainfall averages 45 inches annually, but summer thunderstorms bring about 8 inches during the dry season. Temperatures are cool. The May average is 40 degrees F. and August averages 55 degrees F. There are 103 days between frosts on the average, but below freezing temperatures can occur late in the growing season. The variety of Series includes those found in the

Rogue High Cascade Province, and the Mountain Hemlock and Lodgepole Pine Series.

There is a variety of species and options for their use within the Subprovince. Structural and habitat diversity is also high. Many of the existing stands are uneven aged and contain an unusual amount of vertical diversity. One of the major problems is frost in the Dead Indian Plateau area. Stands in their teens have been damaged or stocking reduced to below standard after removal of the shelterwood. Both radiation frost and topographic frosts are a problem. A plan to deal with the problem is being developed in cooperation with the Medford District of the Bureau of Land Management and the Winema National Forest. Silviculturists should familiarize themselves with the information contained in that Rogue River National Forest document.

## THE SERIES: A POSITIONAL OVERVIEW

Southwest Oregon and northern California forests are known for their vegetative diversity. They provide habitat for over 20 commercial conifers and several commercial hardwoods. Endemic conifers, such as Brewer spruce and Baker's Cypress, are sparsely scattered throughout the area, others species such as Port-Orford-cedar and Sadler oak, are more common. Including all life forms there are over 100 endemic or rare plants in the area (Webb 1988; Sawyer and Thornberg 1974).

This area is the southern limit for the range of Pacific silver fir, Alaska-cedar, and noble fir, and the northern limit for coast redwood, Jeffrey pine, tanoak, and Shasta red fir. It has been referred to by Whitaker (1960) as having central significance to the floral development in the Pacific Northwest Region. Species from different geographical areas are continuing to mix and develop. The grand fir/white fir complex (Zobel 1973, 1974, 1975), and the noble fir/Shasta red fir/California red fir swarm (Franklin et al. 1978) are examples.

Vegetation diversity, a response to the geologic and climatic diversity, provides the creative land manager a unique array of species, operational environments, and thus, silvicultural opportunities.

### HISTORICAL OVERVIEW

Gradual climatic changes have caused shifts in species ranges throughout time. Only in books are ranges fixed. Species continually disperse seed beyond their present range. As the climate changes, the best adapted individuals (able to exploit the site's resources most efficiently) gain dominance and expand their range. This process, plant migration, greatly influences stand composition. Understanding the "origin" of species often gives us a picture of their environmental requirements. Although genetic composition is somewhat plastic, species tend to occur in similar operational environments even after significant climatic changes. For example, during the Ice Ages mountain hemlock occurred at increasing elevation with decreasing latitude, as it does today.

Climatic changes during the Tertiary Period (the first Period of the Cenozoic Era beginning about 60 million years ago) brought in species from more northern latitudes (approximately Alaska and Canada) and the southern latitudes (the Sierra Madres area of northern Mexico) (Axelrod 1976). Northern elements include, but are not limited to, ancestors of mountain hemlock, noble fir, subalpine fir, Pacific silver fir, and Alaska-cedar. These species have evolved since then, but are presently known to inhabit the cooler climates of the area. Subalpine fir occupies the upper elevational slopes near timberline. Mountain hemlock, noble fir, and Alaska-cedar are found at high elevations or on cold northerly aspects. Generally they reflect the environmental requirements of their ancestry. This Arcto-Tertiary geoflora later evolved in the Pacific Northwest and produced a coastal element that resembles today's species.

The coastal element included true firs, Port-Orford-cedar, sitka spruce, western redcedar, coast redwood, and Douglas-fir. Hardwoods similar to dogwood, tanoak, alder, and maple were also present. Today's descendants of the coastal element still require relatively moist summers or inhabit areas where evapotranspirational demand is low. Douglas-fir seems the only exception. Its present range is far greater than any of the other species mentioned.

The Mexican element, the Madro-Tertiary geoflora, developed as the climate dried, expanding northward. Pines, oaks, and madrone are the genera that are still common today. They inhabit drier lowlands and upper slopes where soil water availability is low and evapotranspirational demand is high.

Fossil remains of hardwoods now found in the eastern United States (beech, basswood, and elm, for example) have been found in Oregon, an indication of wet, humid summers (Axelrod 1976) of the Tertiary. The eastern United States climate now satisfies their requirements, but they were gradually out-competed in this area by species that efficiently adapted to dry summers. Elm and other eastern hardwoods can still be found in the Pacific Northwest, in artificial environments, not having to compete for resources.



Two more recent major climatic events affected the local flora: the Ice Ages and the later Xerothermic Period. Ice covered much of the Cascades as far south as Crater Lake, but the Klamath Province was generally spared, except for scattered alpine glaciation on north aspects (Hansen 1955). As would be expected during cold conditions, the northern flora was again pushed south. Mountain hemlock, Pacific silver fir, Alaska-cedar, and noble fir were more common in the southwestern Oregon region. As the climate returned to "normal" they were only able to compete in special habitats such as glacial cirques or the very coldest environments.

The Xerothermic Period, 4000 years of elevated temperatures and dry climate ending about 4000 years ago (Detling 1961), introduced more recent ancestors of the oaks, manzanitas, ceanothus, and other chaparral species. Adapted to hot, dry conditions of the period, these genera became a common component of the flora as far north as southern Washington. As conditions returned to "normal" they were left on islands of shallow soils and hot, dry microclimates. They were, and still are, efficient in the hot, dry, exposed soils left by fire and other disturbances. This group, often associated with vegetative competition, loses efficiency relative to temperate conifers under low light, high moisture, and moderate temperatures.

In summary, the species of northern descent tend to operate most efficiently in the colder environments of the upper elevations or where cold air collects even in late spring (the Dead Indian Plateau east of Ashland is a good example of the latter). Species of southern descent tend to compete well in hot, dry environments on shallow slopes and recently disturbed sites. Species that more or less evolved in the area tend to have warm, wet requirements. They inhabit sites close to the ocean or inland sites that trap moisture and remain humid late into the day during the growing season. This brief, simplified overview only represents the tip of the dynamic nature of species interaction when competing for resources as the climatic regime changes. Yet it illustrates that knowing developmental history can increase understanding of environmental requirements, genetic plasticity, and management potential.

## VEGETATION

Southwestern Oregon has been classified into the western hemlock zone, the Sitka spruce zone and the mixed conifer, mixed evergreen zone (Franklin and Dyrness 1973). Sawyer and Thornburgh (1974) describing the northern California coastal mountain and Siskiyou Mountain flora recognize these generalized zones.

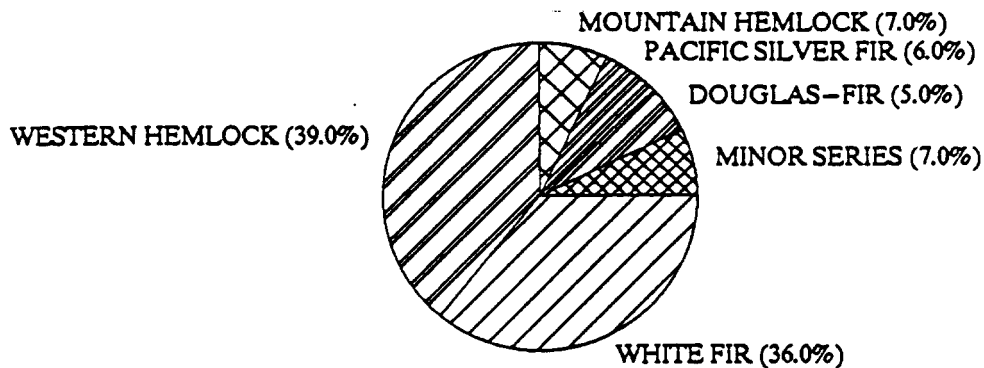
Zones are loosely used to characterize climax vegetation within a broad area. Practical use of zones requires interpretation of the environmental conditions that support more specific taxa. Herein we use series, not zones, because the seral condition of the vegetation provides no climax reference points, and the classification was designed to provide specific management and environmental interpretations. Associations (the finest split in the classification hierarchy) are the vehicles that provide such information.

Descriptions of the sitka spruce zone and the western hemlock zone (Franklin and Dyrness 1973) are essentially unchanged, except for being split into plant associations. But the mixed conifer, mixed evergreen, and white fir zones of the Klamath Province and the subalpine forests of the southern Cascades have been split and rearranged into series that reflect potential, dominant climax species.

### Relative Extent of Series

In the Cascade province, the Western Hemlock Series (39 percent of the area) and the White Fir Series (36 percent of the area) dominate (Figure 3). The former occurs mainly north of the Rogue/Umpqua divide. Conversely, the White Fir Series dominates south of the divide, but both intermix: white fir on dry sites north of the divide, western hemlock on wetter sites south of the divide. The Mountain Hemlock Series, the Pacific Silver Fir Series, and the Douglas-fir Series occupy approximately 7, 6, and 5 percent of the area respectively. The Mountain Hemlock Associations are commonly found in the High Cascades on young soils. The Douglas-fir Series occurs sporadically on shallow soils throughout. Minor series include the Lodgepole Pine Series, which occurs on pumice in frost pockets, the Shasta Red Fir Series, which tends to occur on warmer, south-facing basaltic soils, the Western Redcedar Series, mostly confined to riparian sites, and the Oak

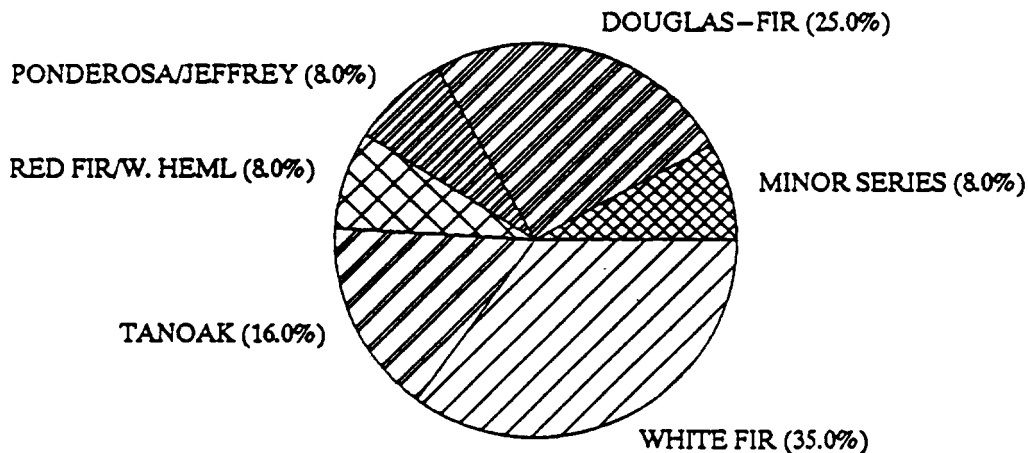
# SERIES OF THE CASCADE MOUNTAINS



MINOR SERIES: LODGEPOLE PINE, SHASTA RED FIR, WESTERN REDCEDAR

Figure 3. Distribution of Series in the Cascade Province

# SERIES OF THE SISKIYOU MOUNTAINS



MINOR SERIES: MT. HEMLOCK, W. WHITE PINE, OAKS, PORT-ORFORD CEDAR  
W. HEMLOCK = 4%, JEFFREY PINE = 4%

Figure 4. Distribution of Series in the Siskiyou Mountains

Series, characteristic vegetation of hot, shallow soils at low elevations.

White fir dominates the Siskiyou Mountain Province (Figure 4). It is the climax dominant on about 35 percent of the area and represents the mid-range of the environment. The Douglas-fir Series, in response to a dry environment, occurs in an elevational zone below the White Fir Series (unlike its scattered Cascade Mountain distribution). The third most extensive series is the Tanoak Series (approximately 15 percent of the area). It dominates warm, wet coastal sites and inland areas that have deep soils and/or low evapotranspirational demand. Four other series, the Western Hemlock, Shasta Red Fir, Jeffrey Pine, and Ponderosa Pine/Oak Series occupy approximately 4 percent of the area each. Other minor Series, such as Port-Orford-cedar, Mountain Hemlock, Western White Pine, and riparian, non-forest meadows, and grasslands occupy the remainder.

## General Characteristics of Major Series

Figure 5 illustrates the elevational distribution of the major Series of the Cascades. They range from the edge of the Rogue Valley at 2000 feet (the Oak Series) to over 7000 feet (the Mountain Hemlock Series).

Low temperatures commonly limit survival and growth above 5000 feet. The Mountain Hemlock Series, and two other minor Series including the Shasta Red Fir and Pacific Silver Fir Series, occur in this limited environment (Figure 6). The Lodgepole Pine Series, interestingly, occurs at an average elevation below 5000 feet, yet it is one of the coldest and most difficult to regenerate (Figure 7). It often occurs in cold air pockets or valleys below major peaks. The pumice flats west of Crater Lake National Park and concavities of the Dead Indian Plateau are examples.

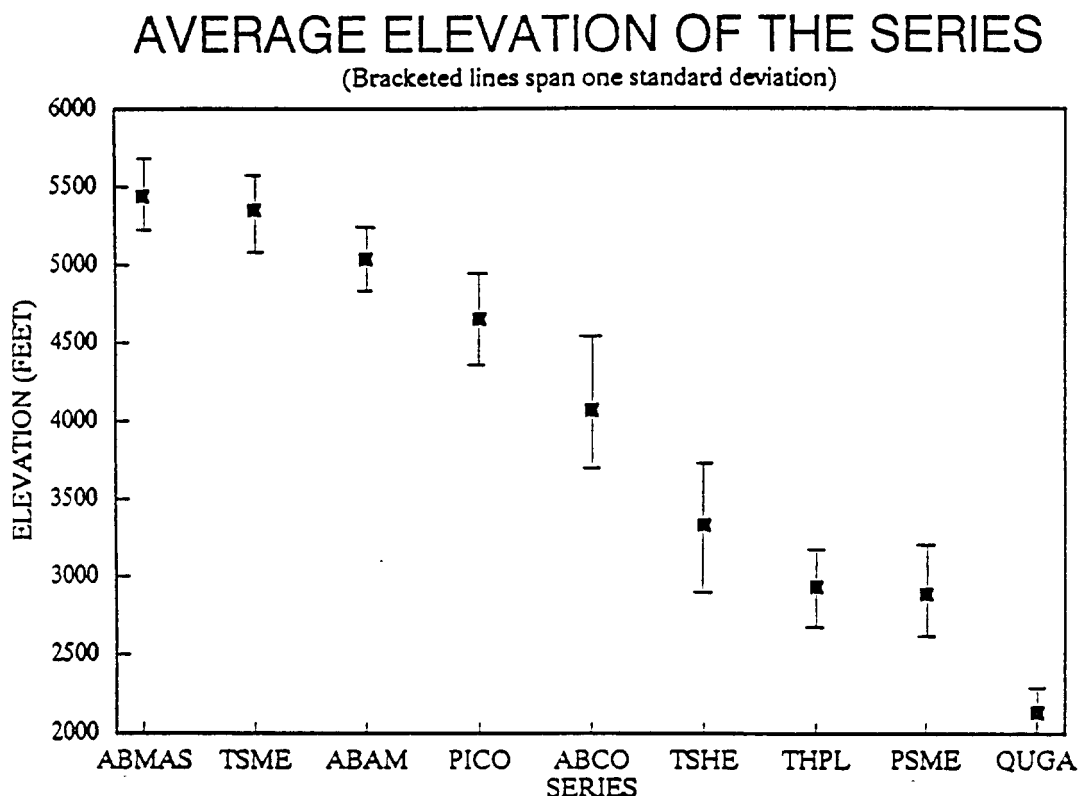


Figure 5. Elevational distribution of Series of the Cascade Province



The Western Hemlock Series occurs at low elevations near the coast, averaging about 2000 feet. Presumably, western hemlock competes well in a temperate, moist environment and is very productive. Thus, a similar or compensating environment is approximately 1000 feet higher in the Cascade Mountains, where the average elevation of the Series is 3335 feet. Since regeneration in the Western Hemlock Series on the coast is not often difficult (Figure 5), it would follow that regeneration at 2500 to 4000 feet in the Cascade Province would **generally** not be difficult.

The Douglas-fir and Oak Series occur at low elevations where diurnal temperature variation is extreme and evapotranspirational demand is high. Both occur on shallow soils at various elevations. Occasionally, isolated stands of ponderosa pine can be found at mid elevations on vertisols. Although saturated in the spring, these soils are droughty during the growing season, and ponderosa may be the only regenerating species. Although ponderosa pine is relatively efficient on hot, dry sites with shallow, droughty soils it is climax on only a few sites in the Province.

Problems with competing vegetation are too pervasive to be well defined at the series level, so the presence of specific competitors better segregates the need for vegetation management. For example, snowbrush ceanothus is common in the White Fir, Western Hemlock, and Douglas-Fir Series, however, it is more likely to affect crop tree growth on specific plant association within each series. These will be covered in the series descriptions.

Figure 8 presents a gross picture of the relative difficulty with vegetation competition by Series. The Mountain Hemlock Series stands out as the least likely to need vegetation management. These high elevation sites are not the most productive in the area and are limited by temperature more often than by lack of resources. In fact some cover of non-crop plants often increases early survival. The White Fir and Western Hemlock include some of our more productive forests and resources become limiting early in the regeneration period. There are over 20 efficient competitors in these Series. The Douglas-fir and Oak Series seem to have fewer competitors or lower abundance, but available water is limited on these drier sites and vegetation management activities can be important.

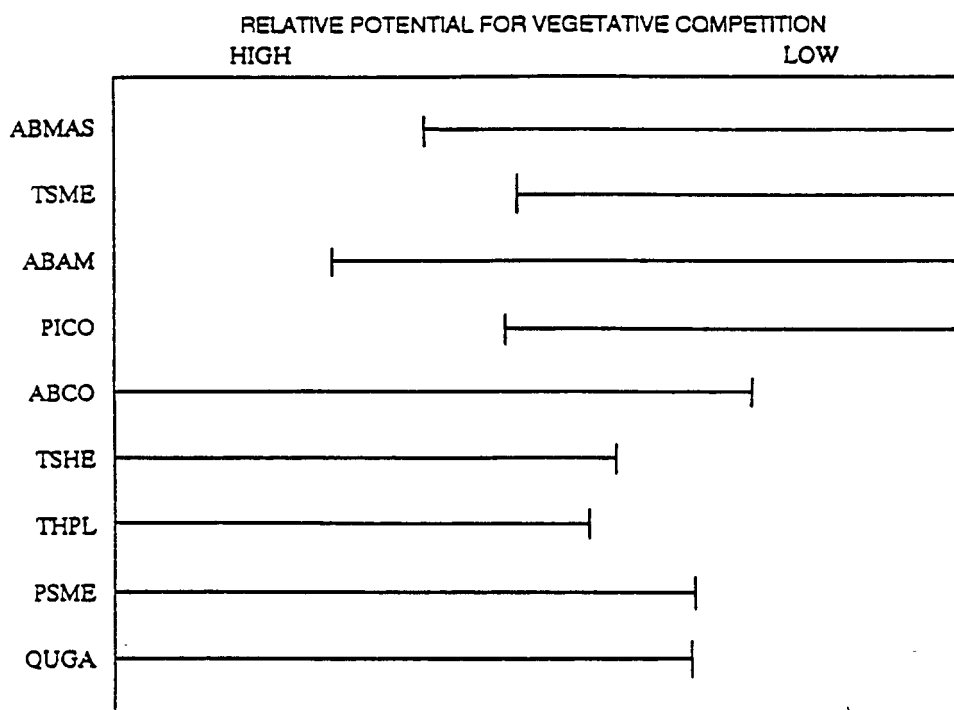


Figure 8. Relative potential for vegetative competition in the Cascade Province Series.

## CASCADE MOUNTAIN PROVINCE KEYS

1a	Lodgepole pine [PICO] is dominant species in overstory and is replacing itself as evidenced by sequence of age classes.	<b>LODGEPOLE PINE KEY (page 21)</b>
1b	Lodgepole pine [PICO] absent or subordinate to other coniferous species in overstory. Lodgepole pine is absent, subordinate, or co-dominant with other coniferous species in understory.	<b>2</b>
2a	Mountain hemlock [TSME] dominant regenerating species.	<b>MOUNTAIN HEM- LOCK KEY (page 21)</b>
2b	Mountain hemlock [TSME] absent or subordinate to other coniferous species in understory.	<b>3</b>
3a	Shasta red fir [ABMAS] dominant regenerating species.	<b>SHASTA RED FIR KEY (page 21)</b>
3b	Shasta red fir [ABMAS] absent or subordinate to other coniferous species in understory.	<b>4</b>
4a	Pacific silver fir [ABAM] dominant regenerating species.	<b>PACIFIC SILVER FIR KEY (page 21)</b>
4b	Pacific silver fir [ABAM] absent or subordinate to other coniferous species in understory.	<b>5</b>
5a	Western redcedar [THPL] dominant regenerating species.	<b>WESTERN RED- CEDAR KEY (page 24)</b>
5b	Western redcedar [THPL] absent or subordinate to other coniferous species in understory.	<b>6</b>
6a	Western hemlock [TSHE] dominant regenerating species.	<b>WESTERN HEM- LOCK KEY (page 22)</b>
6b	Western hemlock [TSHE] absent or subordinate to other coniferous species in understory.	<b>7</b>
7a	White fir [ABCO] dominant regenerating species.	<b>WHITE FIR KEY (page 25)</b>
7b	White fir [ABCO] absent or subordinate to other coniferous species in understory.	<b>DOUGLAS-FIR and OAK KEY (page 27)</b>

## MOUNTAIN HEMLOCK KEY

1a	Subalpine fir [ABLA2] present.	TSME-ABLA2/VASC
1b	Subalpine fir [ABLA2] absent.	2
2a	Pacific rhododendron [RHMA] present.	TSME-ABAM/RHMA
2b	Pacific rhododendron [RHMA] absent.	3
3a	Grouse huckleberry [VASC] present.	4
3b	Grouse huckleberry [VASC] absent.	5
4a	Western twinflower [LIBOL] present.	TSME/CHUM/LIBOL
4b	Western twinflower [LIBOL] absent.	TSME/VASC/ Depauperate
5a	Thin-leaved huckleberry [VAME] present.	TSME-ABMAS/ VAME
5b	Thin-leaved huckleberry [VAME] absent.	TSME/VASC/ Depauperate

## LODGEPOLE PINE KEY

1a	Pinemat manzanita [ARNE] present.	PICO/ARNE/LUPIN
1b	Pinemat manzanita [ARNE] absent.	PICO-TSME/CAPE5

## PACIFIC SILVER FIR KEY

1a	Vine maple [ACCI] present.	ABAM/ACCI/TITR
1b	Vine maple [ACCI] absent.	2
2a	Western hemlock [TSHE] present.	ABAM-TSHE/CLUN
2b	Western hemlock [TSHE] absent.	ABAM/VAME-RULA

## SHASTA RED FIR KEY

1a	Alaska-cedar [CHNO] present.	ABAMS-CHNO
1b	Alaska-cedar [CHNO] absent.	ABMAS/VAME

## WESTERN HEMLOCK KEY

1a	Western redcedar [THPL] present.	2
1b	Western redcedar [THPL] absent.	6
2a	Big-leaf maple [ACMA] with more than 2% cover.	TSHE-ACMA/POMU
2b	Big-leaf maple [ACMA] absent or minor (less than 2% cover).	3
3a	Oregon oxalis [OXOR] present.	4
3b	Oregon oxalis [OXOR] absent.	5
4a	Snow bramble [RUNI] present, dwarf Oregongrape [BENE] with more than 5% cover.	TSHE/ACCI/RUNI
4b	Snow bramble [RUNI] absent, dwarf Oregongrape [BENE] absent or minor (less than 5% cover).	THSE-THPL/OXOR
5a	Douglas-fir [PSME] present in understory.	TSHE-PSME/GASH
5b	Douglas-fir [PSME] absent from understory.	TSHE/GASH/LIBOL
6a	Pacific silver fir [ABAM] understory with more than 5% cover.	TSHE-ABAM/VAME
6b	Pacific silver fir [ABAM] absent from understory or minor (less than 5% cover).	7
7a	Oregon oxalis [OXOR] present.	8
7b	Oregon oxalis [OXOR] absent.	10
8a	Thin-leaved huckleberry [VAME] present.	TSHE/ACCI/OXOR
8b	Thin-leaved huckleberry [VAME] absent.	9
9a	Salal [GASH] with more than 5% cover.	TSHE/GASH/OXOR
9b	Salal [GASH] absent or minor (less than 5% cover).	TSHE/BENE/OXOR(SWO)
10a	Red alder [ALRU] present.	TSHE-ALRU/POMU
10b	Red alder [ALRU] absent.	11
11a	Rocky Mountain maple [ACGL] and starry false Solomon's-seal [SMST] present. Salal [GASH] and Pacific rhododendron [RHMA] absent.	TSHE/ACGL/LIBOL
11b	Rocky Mountain maple [ACGL] or starry false Solomon's-seal [SMST] absent. Salal [GASH] or Pacific rhododendron [RHMA] commonly with more than 20% and 50% cover, respectively.	12



12a	Western white pine [PIMO] present in both layers (understory component may be in the form of intermediate, suppressed, or seeds/saplings). Oregon boxwood [PAMY] <i>and</i> thin-leaved huckleberry [VAME] present.	TSHE/VAME/LIBOL
12b	Western white pine [PIMO] absent, or present in <i>only</i> one layer. Either Oregon boxwood [PAMY] absent or thin-leaved huckleberry [VAME] or both absent.	13
13a	Salal [GASH] with more than 20% cover <i>and</i> Pacific rhododendron [RHMA] with more than 10% cover. Golden chinquapin [CACH] present.	14
13b	Salal [GASH] absent or minor (less than 20% cover) <i>or</i> Pacific rhododendron [RHMA] absent or minor (less than 10% cover). Golden chiquapin [CACH] absent.	15
14a	Pacific yew [TABR] present.	TSHE-TABR/RHMA
14b	Pacific yew [TABR] absent.	TSHE-CADE3/GASH
15a	Salal [GASH] with more than 20% cover.	16
15b	Salal [GASH] absent or minor (less than 20% cover).	18
16a	Pacific rhododendron [RHMA] with more than 15% cover.	TSHE-ABCO/RHMA
16b	Pacific rhododendron [RHMA] absent or minor (less than 15% cover).	17
17a	Common prince's-pine [CHUM] present.	TSHE/GASH-CHUM
17b	Common prince's-pine [CHUM] absent.	TSHE/GASH/HIAL
18a	Pacific rhododendron [RHMA] with more than 5% cover.	19
18b	Pacific rhododendron [RHMA] absent or minor (less than 5% cover).	20
19a	Incense-cedar [CADE3] with more than 10% understory cover.	TSHE-ABCO/RHMA
19b	Incense-cedar [CADE3] absent from understory or minor (less than 10% cover).	TSHE/RHMA/LIBOL(SWO)
20a	Vanillaleaf [ACTR] with more than 5% cover.	TSHE/BENE/ACTR(SWO)
20b	Vanillaleaf [ACTR] absent or minor (less than 5% cover).	TSHE/BENE/LIBOL

## WESTERN REDCEDAR KEY

- |    |  |                 |
|----|--|-----------------|
| 1a | Whipplevine [WHMO], baldhip rose [ROGY], Oregon fairybell [DIHOO],<br>and threleaf anemone [ANDE] present. | THPL/WHMO/ANDE  |
| 1b | None of the above present, or at most one of the four.   | THPL/RHMA/LIBOL |

## WHITE FIR KEY

1a	Poison oak [RHDI] present <i>and</i> Piper's Oregongrape [BEPI] absent.	ABCO/RHDI	
1b	Poison oak [RHDI] absent <i>or</i> poison oak present with Piper's Oregongrape [BEPI] present.		2
2a	Lodgepole pine [PICO] present.	ABCO-PICO/AMAL	
2b	Lodgepole pine [PICO] absent.		3
3a	Pacific silver fir [ABAM] present.		4
3b	Pacific silver fir [ABAM] absent.		5
4a	Western hemlock [TSHE] present.	ABCO-TSHE/ACCI	
4b	Western hemlock [TSHE] absent.	ABCO-ABAM/BENE	
5a	Shasta red fir [ABMAS] present.	ABCO-ABMAS/ CHUM	
5b	Shasta red fir [ABMAS] absent.		6
6a	Mountain hemlock [TSME] present.	ABCO-TSME/VAME	
6b	Mountain hemlock [TSME] absent.		7
7a	Salal [GASH] with more than 10% cover <i>or</i> Pacific rhododendron [RHMA] with more than 10% cover.	ABCO/BENE-GASH	
7b	Salal [GASH] absent or minor (less than 10% cover) <i>and</i> Pacific rhododendron [RHMA] absent or minor (less than 10% cover).		8
8a	California black oak [QUKE] present.	ABCO/COCOC- AMAL	
8b	California black oak [QUKE] absent.		9
9a	Thin-leaved huckleberry [VAME] <i>and</i> Pacific yew [TABR] present, vanillaleaf [ACTR] absent.	ABCO/VAME/LIBOL	
9b	Thin-leaved huckleberry [VAME] <i>or</i> Pacific yew [TABR] absent, if both present then vanillaleaf [ACTR] present also.		10
10a	Snow bramble [RUNI] present <i>and</i> vine maple [ACCI] absent or minor (less than 5% cover).	ABCO/RUNI/ACTR	
10b	Snow bramble [RUNI] absent <i>or</i> snow bramble present with vine maple [ACCI] with more than 5% cover.		11

11a	Vine maple [ACCI] with more than 10% cover <i>and</i> vanillaleaf [ACTR] present, usually with more than 5% cover. Oregon boxwood [PAMY] absent and catchweed bedstraw [GAAP] usually present.	ABCO/ACCI/ACTR
11b	Vine maple [ACCI] absent or minor (less than 10% cover) <i>or</i> vanillaleaf [ACTR] not as described above.	12
12a	Thin-leaved huckleberry [VAME] present <i>and</i> Oregon boxwood [PAMY] <i>or</i> Pacific yew [TABR] present.	ABCO/VAME/ACTR
12b	Thin-leaved huckleberry [VAME] absent, <i>or</i> thin-leaved huckleberry present with Oregon boxwood [PAMY] <i>and</i> Pacific yew [TABR] absent.	13
13a	Rocky Mountain maple [ACGL] present <i>and</i> Oregon boxwood [PAMY] absent.	ABCO/ACGL/BENE
13b	Rocky Mountain maple [ACGL] absent, <i>or</i> Rocky Mountain maple present with Oregon boxwood [PAMY] present.	14
14a	Western serviceberry [AMAL] <i>and</i> Oregon boxwood [PAMY] present.	ABCO/AMAL/ANDE
14b	Western serviceberry [AMAL] <i>or</i> Oregon boxwood [PAMY] absent.	15
15a	Piper's Oregongrape [BEPI] present.	ABCO-PSME/BEPI
15b	Piper's Oregongrape [BEPI] absent.	16
16a	Incense-cedar [CADE3] present.	ABCO-CADE3/BENE
16b	Incense-cedar [CADE3] absent.	17
17a	Western prince's-pine [CHUM] with more than 10% cover.	ABCO/CHUM/ PYROLA
17b	Western prince's-pine [CHUM] absent or minor (less than 10% cover).	ABCO/BENE/ANDE

## DOUGLAS-FIR and OAK KEY

1a	Wedgeleaf ceanothus [CECU] present.	2
1b	Wedgeleaf ceanothus [CECU] absent.	3
2a	Douglas-fir [PSME] present.	PSME/CECU
2b	Douglas-fir [PSME] absent.	CECU/CYEC
3a	Oregon white oak [QUGA] present.	4
3b	Oregon white oak [QUGA] absent.	5
4a	Hedgehog dogtail [CYEC] present.	QUGA/FRVEB
4b	Hedgehog dogtail [CYEC] absent.	PSME-QUGA/RHDI
5a	Jeffrey pine [PIJE] present.	PSME-PIJE
5b	Jeffrey pine [PIJE] absent.	6
6a	Poison oak [RHDI] present.	7
6b	Posion oak [RHDI] absent.	8
7a	California black oak [QUKE] present.	PSME/RHDI/CYGR
7b	California black oak [QUKE] absent.	PSME/RHDI/PTAQ
8b	Salal [GASH] present.	PSME/GASH/POMU
8a	Salal [GASH] absent.	PSME/BENE/POMU

## MOUNTAIN HEMLOCK SERIES

*Tsuga mertensiana*

### TSME

The coastal range of mountain hemlock extends from the Kenai Peninsula, Alaska to the southern Oregon Cascades. Scattered populations are found in the Siskiyou Mountains south to the mid Sierras in California. The interior range is much more limited, extending from southeastern British Columbia into northern Idaho and Montana (Little 1971).

In the southern Cascades, mountain hemlock occurs in scattered north-facing, glaciated concavities at high elevation and in intermittent cold pockets, usually above 3,000 feet (although individuals have been found about the 2,000 foot level). Continuous stands are more common as latitude increases. Most stands occur in the relatively young ash and pumice soils of the High Cascade Province.

It is efficient in cold, moist climates and is outcompeted to the west as growing season temperatures increase and to the east as the rainshadow of the Cascades reduces available moisture. The species occurs on all types of soils and grows well even in low light.

Mountain hemlock is considered a late successional or climax species. It is shade tolerant, reproduces well on organic substrates, and tends to cycle nutrients internally. Not many nutrients are lost by needle drop, an advantage in environments where external cycling is slowed by cold temperatures.

### THE SERIES

**EXTENT:** Occurs on the Rogue and Umpqua National Forests in both High and Western Cascade Subprovinces. N = 31 plots.

**IDENTIFYING CHARACTERISTICS:** Mountain hemlock is associated with a variety of species in the overstory and understory but most frequently with Shasta red fir (70 percent). The most frequent shrub layer companions are common prince's-pine (67 percent) and thin-leaved huckleberry (54 percent).

The dominance of mountain hemlock in the regeneration differentiates this Series from the others. The average cover of Shasta red fir is much less (9.5 percent) than that of mountain hemlock (29.8 percent).

**ABIOTIC ENVIRONMENT:** Mountain hemlock is found primarily on igneous extrusive parent materials which range from andesite and basalt to pumice and ash. Total soil depth and rooting depth are typical for the Cascade Province. Mountain hemlock is found at one of the highest elevations (5349 feet) of the series with Shasta red fir, the highest, found only slightly higher in average elevation (5444 feet). The aspect averages northwest, but is variable. The average slope (17 percent) is less than the Cascade average (30 percent). The Mountain Hemlock Series is found on all slope positions from ridgetop to lower third of the slope, but occurs most often on the upper third. The landscape is frequently flat, though it may be convex, concave or undulating.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	4460	6660	2200	5349.0	507.0	the high end of the population
Aspect (deg)	—	—	—	313.0	105.6	northwest with a lot of variation
Slope (%)	0	60	60	17.3	14.6	below average for the population
Total soil depth (in)	7.9	50.0	42.1	40.19	13.1	same as population average
Rooting depth (in)	19.7	50.0	30.3	46.6	8.1	same as population average
Total basal area (ft <sup>2</sup> /ac)	100	800	700	263.5	130.0	slightly below population average

**CLIMATE:** The Mountain Hemlock Series is colder and wetter than the average for the Cascade

Province (Figure 9). Cold temperatures and a short growing season limit growth.

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	38.1	43.5	5.4	41.2	1.3	lower than population average
Maximum month temp (F)	68.0	76.6	8.6	73.2	2.1	lowest average for all series
Mean annual ppt (in)	50	70	20	63.2	5.5	higher than population average
Dry season ppt (in)	7	10	3	8.2	1.0	slightly higher than population average

**FOREST FLOOR:** The litter cover is about average for the Cascade Province due to the small amounts of litter produced in combination with the slowing of

decay by the cold temperatures. The cold temperatures also minimize the cover of moss.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	50	100	50	91.8	11.7	slightly less than population average
Moss (%)	0	60	60	5.7	11.1	lower than the population average
Bareground (%)	0	18	18	1.4	3.3	
Gravel (%)	0	5	5	1.3	1.6	
Rock (%)	0	40	40	4.5	8.5	
Bedrock (%)	0	10	10	.4	1.8	

### MOUNTAIN HEMLOCK, LODGEPOLE PINE, SHASTA RED FIR AND PACIFIC SILVER FIR PLANT ASSOCIATIONS

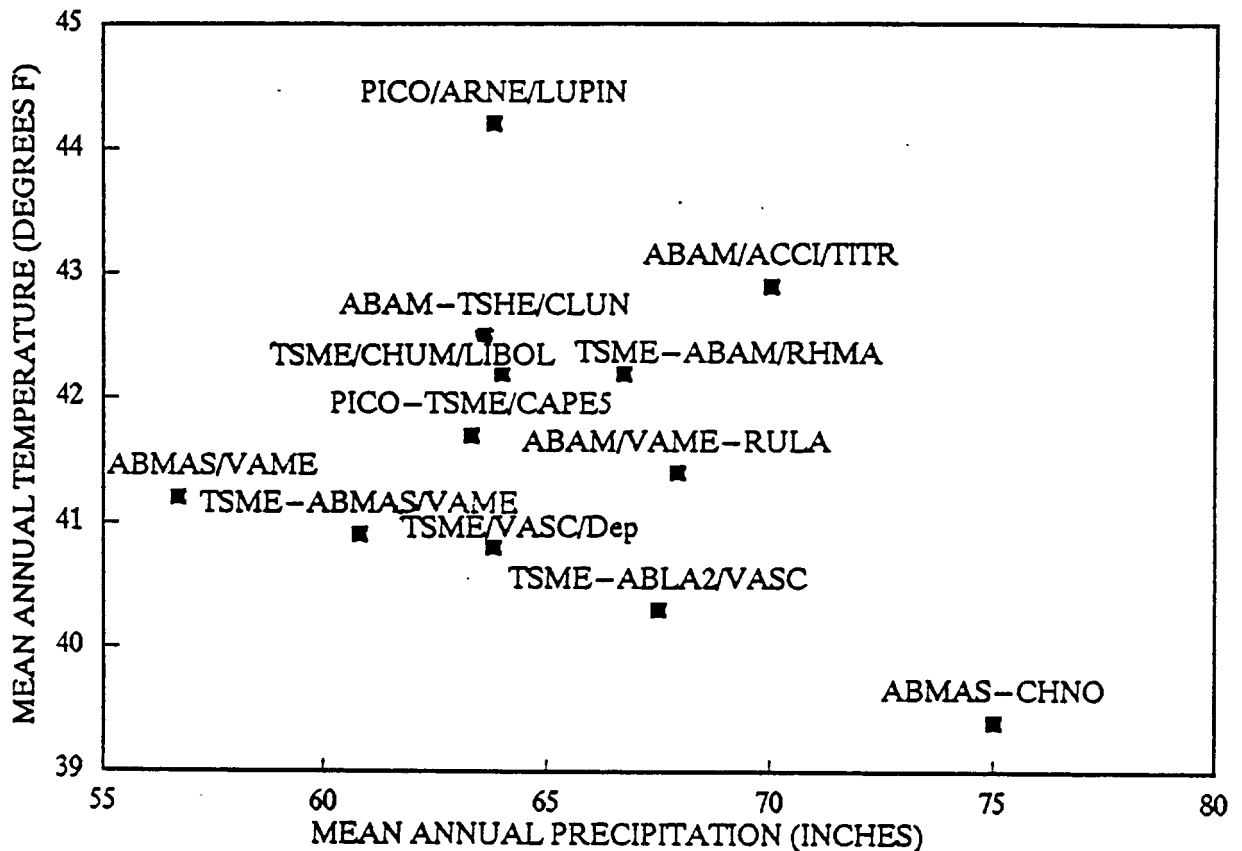


Figure 9. Ecograph of Mountain Hemlock, Lodgepole Pine, Shasta Red Fir, and Pacific Silver Fir Plant Associations.

**VEGETATION:** Shasta red fir, lodgepole pine, and western white pine are its common associates. Sub-alpine fir is more common on moist sites as is Engelmann spruce on wet sites with a high water table. Douglas-fir, white fir, sugar pine, incense-cedar and western hemlock are scattered throughout its range but less commonly associated with mountain hemlock. Ponderosa pine is rarely found toward the eastern edge of its range. The most common associated shrubs are thin-leaved huckleberry and common prince's-pine. Grouse huckleberry, dwarf bramble, Oregon boxwood, dwarf Oregongrape and pinemat manzanita are occasional associates.

**SILVICULTURE:** Historically, the regeneration of large clearcuts has been difficult. On occasion species selection (artificial regeneration with Douglas-fir) has been inappropriate, but extreme cold also kills a high percentage of natural seedlings. Slopes less than 15 percent are the most susceptible to frost. Mountain hemlock is a prolific seeder and natural regeneration is often observed near the edges of clearcuts depending on their orientation to snow accumulation, sun, and wind. Information on the competitive effects of the huckleberries on regeneration survival and growth is scarce.

Biomass and timber volume production is limited by cold soil and air temperatures. Productivity varies greatly by Plant Association. The warmest sites with the complement of midslope herbs are the most productive. Refer to the discussion of the individual Plant Associations.

The Series can be split into two groups based on broad environmental similarity. These groups are to help describe the environments they occur in and have no "political status" in the Series/Association hierarchy. The first group includes the **TSME/VASC/Dep** (mountain hemlock/thin-leaved huckleberry/depauperate), **TSME-ABLA2/VASC** (mountain hemlock-subalpine fir/thin-leaved huckleberry), and **TSME/CHUM/LIBOL** (mountain hemlock/common prince's-pine/western twinflower) Associations. The second group includes the **TSME-ABAM/RHMA** (mountain hemlock-Pacific silver fir/Pacific rhododendron) and **TSME-ABMAS/VAME** (mountain hemlock-Shasta red fir/thin-leaved huckleberry) Associations. **TSME/CHUM/LIBOL** is transitional between the two groups, however, it has most in common with the first group. The following table displays the major differences.

CHARACTERISTICS	TSME/VASC/Dep TSME-ABLA2/VASC TSME/CHUM/LIBOL	TSME-ABAM/RHMA TSME-ABMAS/VAME
Parent rock	Pumice and ash	Andesite and basalt
Physiographic province	High Cascades	Western Cascades
Elevation	Highest elevation forests	Occurs at lower elevations
Slope	Mostly on flat slopes	Generally on steeper slopes
Fire regime	Intense, infrequent	Varies but more frequent
Diversity	Low species diversity	Increased species diversity
Structural variety	Not much structural variety	Multistoried stands and shrub structure
Visual variety	Low with great background	Increased foreground variety
Recreation	Dispersed opportunities	Access steep and difficult
Productivity	Low productivity	Increased productivity
Silviculture	Reforestation problems Fragile system	Understory shrub competition Resilient system

Management opportunities for this Series are quite limited. The deep, persistent snow pack, short, cool growing season, and poorly developed soils make

regeneration difficult and productivity low. Other aspects of management include use of the Series as thermal and hiding cover for wildlife, watershed protection, and recreation. The following silvicultural



considerations are important when mountain hemlock stands are managed for timber production.

1. Advanced regeneration and subsequent natural regeneration may provide the most reliable source for a new stand in five years. Protection of advanced regeneration during harvest is essential. Damaged regeneration is very susceptible to rot.
2. Establishment of natural regeneration is dependent on unit size. Smaller clearcuts maximize edge effect and will accelerate regeneration establishment, particularly south edges. However small, many units remain understocked even after five years. Limited experience indicates a shelterwood can provide adequate regeneration in five to ten years. However, as with advance regeneration, young trees must be well protected during overstory removal. Of course, the option to leave the overstory for animal habitat, organic deposition, and production of large snags is attractive. It may cost only several trees per acre, yet significantly decrease the risk of losing or introducing rot into an established stand.
3. Planting has been relatively ineffective on these cold, snowy sites. Timing is critical for artificial regeneration. Plant soon after snow melt. Casual observation indicates that a nurse crop of lodgepole pine may be an effective way of dampening temperature extremes thus, reducing seedling mortality. Other hardy conifers (lodgepole pine), hardwoods, and shrubs may also be effective.
4. Gooseberries or currants (*Ribes* spp.) are common in many Plant Associations and represent potential sources of western white pine blister rust, thus increasing the risk of failure for western white pine.
5. Granitic or pyroclastic (pumice and ash) soils present regeneration problems. Poor heat retention and low soil moisture availability create extreme seedling environments. In areas with aerial deposited pumice/ash, particle bridging may be a problem. This occurs when the interlocking of the rough, gravel sized pumice acts as a physical barrier to

limit fine root proliferation and decreases water availability (Cochran 1971). This does not occur with waterlain or reworked pumice (Cochran pers comm). As mentioned above (item 2), small units or partial harvest methods may ameliorate the extremes. Additionally, care should be taken to maintain an intact litter layer which acts to moderate extremes in soil moisture and temperature. Other benefits include increased organic matter and fertility, reduced surface erosion, and increased numbers of microsites for planting. Soils derived from granitics are exceptionally prone to surface erosion and mass wasting. **Site preparation, particularly burning and machine methods, can seriously decrease site productivity.**

**WATERSHED MANAGEMENT:** Most of the precipitation is in the form of snow, though infrequent summer rains may be intense. Mountain hemlock stands store water well into the growing season. Summer water yields are partly dependent on that pack. Soils are well drained, developed from pumice/ash or andesite/basalt. Growth rates are slow, thus, vegetation recovery is slow. Maintaining healthy native vegetation is the best defense against erosion or sedimentation.

**FIRE MANAGEMENT:** Fire occurs infrequently. Many stands, some over 200 years old, show no outward evidence of fire. Scars are infrequently found on a few trees in a limited area, likely the result of a low intensity, localized lightning fire. Fire spread is limited by low fine fuel loadings, high moisture content (slow drying) and cool temperatures. When fires do occur, they tend to be stand replacement fires.

**RANGE AND WILDLIFE MANAGEMENT:** Old, unmanaged stands have a variety of vertical structure: old mature limby trees, snags, various sizes of regeneration of several different species and a low shrub layer. Hiding and thermal cover are spotty but not rare.

In terms of livestock forage, herbage production is low and water sources are scarce. The season would be short as the snow lingers most springs and the soils are delicate. Continual movement would be needed to avoid overuse and prevent resource damage.

**RECREATION AND VISUAL MANAGEMENT:** The average slope is gentle (17 percent) and the terrain is not difficult to traverse. The potential for dispersed recreational activities, such as hiking, cross-country skiing, birding and hunting is high. Summer temperatures can be cold and midsummer snows are oc-

casional. Fragile soils and the cold, short growing season slow revegetation on disturbed sites. Compaction of developed recreation sites would decrease plant growth.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	6%	5	10	5	7.5	3.5	
ABCO	white fir	19%	1	40	39	11.5	14.3	
ABLA2	subalpine fir	6%	1	2	1	1.5	.7	
ABMAS	Shasta red fir	70%	5	55	50	25.7	15.6	
CADE3	incense-cedar	3%	5	5	0	5.0	0	
PIEN	Engelmann spruce	6%	10	40	30	25.0	21.2	
PICO	lodgepole pine	25%	2	57	55	14.2	18.2	
PILA	sugar pine	3%	5	5	0	5.0	.0	
PIMO	western white pine	45%	1	30	29	9.4	7.8	
PSME	Douglas-fir	38%	4	40	36	17.4	11.1	
TSHE	western hemlock	3%	5	5	0	5.0	.0	
TSME	mountain hemlock	80%	2	70	68	23.9	18.9	
	TOTAL OVERSTORY	100%	30	91	61	57.1	14.1	
—CONIFERS—								
ABAM	Pacific silver fir	12%	1	15	14	5.8	6.4	
ABCO	white fir	54%	1	25	24	8.8	5.4	
ABLA2	subalpine fir	6%	25	30	5	27.5	3.5	
ABMAS	Shasta red fir	70%	2	20	18	9.5	6.3	
PIEN	Engelmann spruce	6%	2	5	3	3.5	2.1	
PICO	lodgepole pine	25%	1	15	14	6.8	4.7	
PILA	sugar pine	3%	5	5	0	5.0	.0	
PIMO	western white pine	54%	1	12	11	4.8	3.1	
PSME	Douglas-fir	25%	1	25	24	7.1	8.0	
TSHE	western hemlock	6%	12	15	3	13.5	2.1	
TSME	mountain hemlock	100%	5	60	55	29.8	14.2	
—HARDWOODS—								
ACCI	vine maple	3%	1	1	0	1.0	.0	
ACGL	Douglas maple	6%	10	10	0	10.0	.0	
CACH	golden chinquapin	29%	1	50	49	13.2	17.1	
	TOTAL UNDERSTORY	100%	6	117	111	55.8	25.7	
AMAL	western serviceberry	12%	1	3	2	1.5	1.0	
ARNE	pinemat manzanita	29%	2	45	43	12.4	17.2	
BENE	dwarf Oregongrape	29%	1	15	14	4.4	4.5	
CEPR	squaw carpet	3%	2	2	0	2.0	.0	
CHME	little prince's-pine	3%	10	10	0	10.0	.0	
CHUM	common prince's-pine	67%	1	30	29	10.2	9.7	
GAOV	slender salal	9%	1	20	19	8.0	10.4	
PAMY	Oregon boxwood	32%	1	20	19	3.6	5.9	
RHMA	Pacific rhododendron	12%	50	95	45	80.0	21.2	
RIBES	currant spp.	9%	1	12	11	5.0	6.1	
RILO	gummy gooseberry	6%	3	8	5	5.5	3.5	
RIVI	sticky currant	12%	1	5	4	2.0	2.0	
RULA	dwarf bramble	35%	1	10	9	3.5	2.6	
RUPA	thimbleberry	3%	1	1	0	1.0	.0	
RUUR	Pacific blackberry	12%	1	1	0	1.0	.0	
SOSI	Sitka mountain-ash	6%	1	1	0	1.0	.0	
VAME	thin-leaved huckleberry	54%	1	90	89	42.9	30.7	
VAPA	red huckleberry	3%	2	2	0	2.0	.0	
VASC	grouse huckleberry	45%	1	50	49	14.0	14.3	
	TOTAL SHRUB	100%	3	113	110	57.2	33.2	

## MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	19%	1	12	11	5.0	4.4	
ANDE	threeleaf anemone	25%	1	5	4	2.6	1.3	
ANLY2	Lyall anemone	16%	1	1	0	1.0	.0	
APAN	spreading dogbane	3%	2	2	0	2.0	.0	
AQFO	Sitka columbine	3%	1	1	0	1.0	.0	
ARMA3	bigleaf sandwort	16%	1	1	0	1.0	.0	
CASC2	rough harebell	12%	1	2	1	1.3	.5	
CLUN	queen's cup	32%	1	5	4	2.9	1.4	
COMA3	spotted coral-root	6%	1	1	0	1.0	.0	
COME	Pacific coral-root	6%	1	1	0	1.0	.0	
COST2	hooded coral-root	12%	1	1	0	1.0	.0	
DACA4	California oatgrass	3%	5	5	0	5.0	.0	
DIFO	Pacific bleedingheart	9%	1	2	1	1.3	.6	
DIHOO	Oregon fairybell	9%	1	1	0	1.0	.0	
EPAN	fireweed	6%	1	1	0	1.0	.0	
ERPU	shaggy fleabane	3%	2	2	0	2.0	.0	
FRVEB	woods strawberry	16%	1	2	1	1.2	.4	
GAAP	catchweed bedstraw	3%	1	1	0	1.0	.0	
GAOR	Oregon bedstraw	6%	2	2	0	2.0	.0	
GOOB	rattlesnake-plantain	22%	1	1	0	1.0	.0	
HIAL	white-flowered hawkweed	19%	1	1	0	1.0	.0	
LIBOL	western twinflower	29%	3	60	57	16.0	17.8	
LICA3	northwest listera	41%	1	2	1	1.1	.3	
LUPIN	lupine spp.	3%	1	1	0	1.0	.0	
MECI	ciliate bluebells	3%	2	2	0	2.0	.0	
MEPA	tall bluebells	3%	1	1	0	1.0	.0	
MEPL	broadleaved bluebells	3%	2	2	0	2.0	.0	
MOSI	candyflower	3%	1	1	0	1.0	.0	
OSCH	mountain sweet-root	9%	2	2	0	2.0	.0	
PERA	leafy lousewort	25%	1	3	2	1.4	.7	
PHHEP	vanilla leaf phacelia	3%	1	1	0	1.0	.0	
POMU	western sword-fern	3%	1	1	0	1.0	.0	
PRVU	self-heal	3%	1	1	0	1.0	.0	
PTAQ	bracken	6%	1	4	3	2.5	2.1	
PTAN	woodland pinedrops	3%	1	1	0	1.0	.0	
PYAP	leafless pyrola	3%	1	1	0	1.0	.0	
PYAS	alpine pyrola	6%	1	2	1	1.5	.7	
PYP1	whitevein pyrola	16%	1	1	0	1.0	.0	
PYSE	one-sided pyrola	48%	1	5	4	1.7	1.4	
SETR	arrowleaf groundsel	3%	1	1	0	1.0	.0	
SMRA	western false Solomon's-seal	3%	2	2	0	2.0	.0	
SMST	starry Solomon-plume	12%	1	5	4	2.3	1.9	
SYRE	snow-queen	3%	6	6	0	6.0	.0	
TITR	foamflower	3%	5	5	0	5.0	.0	
TRLA2	western starflower	3%	2	2	0	2.0	.0	
TROV	white trillium	35%	1	2	1	1.1	.3	
VASI	mountain heliotrope	6%	1	1	0	1.0	.0	
VAHE	white inside-out-flr	12%	1	5	4	3.0	1.8	
VECA	Calif. false hellebore	6%	1	5	4	3.0	2.8	
VIGL	stream violet	35%	1	3	2	1.3	.6	
VIOR2	round-leaved violet	6%	1	1	0	1.0	.0	
XETE	common beargrass	12%	1	60	59	32.7	25.6	
	TOTAL HERB	100%	0	97	97	18.5	24.0	

MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
AGROS		3%	1	1	0	1.0	.0	
AIPR	early hairgrass	3%	1	1	0	1.0	.0	
BROMU	brome spp.	6%	1	1	0	1.0	.0	
BRER	meadow brome	6%	1	2	1	1.5	.7	
BRVU	Columbia brome	6%	1	2	1	1.5	.7	
CACA	bluejoint reedgrass	3%	1	1	0	1.0	.0	
CAREX	sedge spp.	19%	1	3	2	1.7	.8	
CAPE5	long-stolon sedge	6%	1	1	0	1.0	.0	
ELGL	blue wildrye	3%	1	1	0	1.0	.0	
JUNCU	rush spp.	3%	1	1	0	1.0	.0	
JUPA	Parry's rush	3%	1	1	0	1.0	.0	
LUHI	smooth woodrush	3%	1	1	0	1.0	.0	
MESU	Alaska oniongrass	6%	1	1	0	1.0	.0	
SITAN	squirreltail spp.	3%	1	1	0	1.0	.0	
STIPA	needlegrass spp.	3%	1	1	0	1.0	.0	
	TOTAL GRASS	100%	0	6	6	1.1	1.4	

## MOUNTAIN HEMLOCK KEY

- |    |   |                     |
|----|---|---------------------|
| 1a | Subalpine fir [ABLA2] present.          | TSME-ABLA2/VASC     |
| 1b | Subalpine fir [ABLA2] absent.           | 2                   |
|    |   |                     |
| 2a | Pacific rhododendron [RHMA] present.    | TSME-ABAM/RHMA      |
| 2b | Pacific rhododendron [RHMA] absent.     | 3                   |
|    |   |                     |
| 3a | Grouse huckleberry [VASC] present.      | 4                   |
| 3b | Grouse huckleberry [VASC] absent.       | 5                   |
|    |   |                     |
| 4a | Western twinflower [LIBOL] present.     | TSME/CHUM/LIBOL     |
| 4b | Western twinflower [LIBOL] absent.      | TSME/VASC/Dep       |
|    |   |                     |
| 5a | Thin-leaved huckleberry [VAME] present. | TSME-ABMAS/<br>VAME |
| 5b | Thin-leaved huckleberry [VAME] absent.  | TSME/VASC/Dep       |

## MOUNTAIN HEMLOCK ASSOCIATIONS

TSME-ABLA2/VASC pg. 37	Mountain hemlock - Subalpine fir / Grouse huckleberry <i>Tsuga mertensiana</i> - <i>Abies lasiocarpa</i> / <i>Vaccinium scoparium</i>
TSME/VASC/Dep pg. 40	Mountain hemlock / Grouse huckleberry / Depauperate <i>Tsuga mertensiana</i> / <i>Vaccinium scoparium</i> / <i>Depauperate</i>
TSME/CHUM/LIBOL pg. 43	Mountain hemlock / Common prince's-pine / Western twinflower <i>Tsuga mertensiana</i> / <i>Chimaphila umbellata</i> / <i>Linnaea borealis longiflora</i>
TSME-ABMAS/VAME pg. 47	Mountain hemlock - Shasta red fir / Thin-leaved huckleberry <i>Tsuga mertensiana</i> - <i>Abies magnifica shastensis</i> / <i>Vaccinium membranaceum</i>
TSME-ABAM/RHMA pg. 51	Mountain hemlock - Pacific silver fir / Pacific rhododendron <i>Tsuga mertensiana</i> - <i>Abies amabilis</i> / <i>Rhododendron macrophyllum</i>

**MOUNTAIN HEMLOCK - SUBALPINE FIR / GROUSE HUCKLEBERRY**  
*Tsuga mertensiana* - *Abies lasiocarpa* / *Vaccinium scoparium*  
**TSME-ABLA2/VASC**

**EXTENT:** This Association occurs on the Diamond Lake Ranger District on pumice/ash in the High Cascades Subprovince. N = 2 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of subalpine fir in the overstory and the understory differentiates this Association from the others in the Series. Lodgepole pine and mountain hemlock dominate the overstory with subalpine fir and mountain hemlock co-occurring in the understory. The shrub, herb and grass(like) layers are very sparse with grouse huckleberry dominant.

**ABIOTIC ENVIRONMENT:** Soils are derived from pyroclastic material, pumice and ash. Roots penetrate to over 50 inches even on recent pyroclastics with limited A/C horization. However, only the top few inches support fine root growth although the tap roots are deep. Ash soils in the area have a low cation exchange capacity and organic matter content, averaging (N=10) 2.1 percent litter cover. Pumice can hold significant amounts of water, though in aerial deposited pumice, particle bridging may act as a physical barrier to limit root proliferation and decrease availability of water (Cochran 1971). Heat capacities are low. Organic matter increases water holding capacity, heat capacity, and cation exchange capacity. The topography is generally flat or shallowly sloped and in many cases collects cold air. Basal area is the lowest for the Series and site productivity is low.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5695.0	35.0
Aspect (deg)	277.3	80.3
Slope (%)	6.5	7.8
Total soil depth (in)	50.0	.0
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	190.0	42.4

**CLIMATE:** The association is found at the upper elevations of the Series. Stands are often found in cold air drainages or pockets where frost potential is high. They dry and cool quickly and thus, tend to enhance frost damage on small seedlings. Extreme diurnal fluctuations in both soil and ambient temper-

atures prevail throughout the growing season. Annual growth rates are slow due to short growing seasons and low growing season temperatures. Available soil moisture is depleted early in the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	40.3	.3
Maximum month temp (F)	71.9	.1
Mean annual ppt (in)	67.5	3.5
Dry season ppt (in)	8.5	2.1

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.5	2.1
Moss (%)	4.0	2.8
Bareground (%)	1.0	.0
Gravel (%)	2.5	3.5
Rock (%)	.0	.0
Bedrock (%)	.0	.0

**VEGETATION:** Mountain hemlock and lodgepole pine are dominant, but subalpine fir is present in the overstory. Shasta red fir may also be present. Subalpine fir and mountain hemlock co-occur and dominate the understory. Lodgepole pine is still present, but with much less cover than in the overstory. Grouse huckleberry is the only shrub present and has a relatively low cover. The herbaceous layer is sparse with few herbs, grasses, and grasslike plants present.

**SILVICULTURE:** Disturbance of the soil surface layers can have long term effects. Most of the available nutrients (except for those cycled internally) are stored in the top 8 inches. Yarding and site preparation activities that displace or remove the top layers decrease the site's potential for supporting a commercial crop. Since cold is the most limiting factor affecting survival and growth, manipulation of heat storage and flow is often critical for successful regeneration. Trees, live or dead, standing or down, rocks, and intact soil act as effective

heat sinks. Leaving an overstory will reduce the loss of heat from the site depending on the amount and distribution of canopy left. For lightly disturbed soils with shelterwood or heavier overstory, mountain hemlock, white fir, and western white pine are appropriate for regeneration. Lodgepole pine, mountain hemlock, and western white pine seem to do well in the open and on disturbed sites. Productivity is the lowest for the TSME Series.

**WATERSHED MANAGEMENT:** Most precipitation is in the form of snow. Soils are well-drained, developed from pumice/ash. The pyroclastic soils may hold significant amounts of moisture in the subsurface layers that is difficult for the plants to tap. Pyroclastic soils are also subject to erosion. However, the terrain is generally flat or gently sloped. Summer water yields are partly dependent on snowpacks that remain well into summer. Attempts have been made to arrange cutting patterns to increase the pack and retard its melt (Troendle and Meiman 1984).

**FIRE MANAGEMENT:** Fire occurs infrequently. Mountain hemlock and Shasta red fir, which are easily killed or scarred by fire, are mostly free of damage. Many stands, some over 200 years old, have no outward evidence of fire. Scars are infrequently found on a few trees in a limited area, likely

the result of a low intensity, localized, lightning fire. Fire spread is limited by low fine fuel loadings, high fuel moisture content (slow drying), and cool temperatures. When fires do occur they tend to be stand replacement fires that create extensive areas of even-aged lodgepole pine.

**RANGE & WILDLIFE MANAGEMENT:** Although forage is essentially absent, the full-crowned conifers often provide hiding and thermal cover for big game. Small mammals and birds are primary users.

**RECREATION & VISUAL MANAGEMENT:** The flat and generally open terrain has potential for dispersed recreational activities, such as hiking and cross-country skiing. However, shallow soils, lack of plant diversity, and the cold, short growing season create a fragile environment. Disturbed topsoil or harshly treated areas will heal slowly and scars are long evident. Roadside stabilization is sometimes a problem. Cutbanks can be planted with lodgepole pine, lupines, pinemat manzanita, and long-stolon sedge.

Many stands are uniform in size, extensive (see the section on fire above) and lack visual variety. However, they often blanket the lower slopes of the Cascade volcanoes. Human activities often stand out.



# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABLA2	subalpine fir	100%	1.5	.7	moist, cold meadows
ABMAS	Shasta red fir	50%	5.0	.0	south slopes, warmer sites, pioneer
PICO	lodgepole pine	100%	38.5	26.2	high nutrient demand, pioneer
TSME	mountain hemlock	100%	18.5	23.3	slow growth, internal nutrient cycling
	TOTAL OVERSTORY	100%	61.0	1.4	
ABLA2	—CONIFERS— subalpine fir	100%	27.5	3.5	cold limited site
PICO	lodgepole pine	100%	6.5	4.9	pioneers any new, bare soil
TSME	mountain hemlock	100%	32.5	24.7	mixes with western hemlock
	TOTAL UNDERSTORY	100%	66.5	23.3	
VASC	grouse huckleberry	100%	15.5	13.4	cold, moist sites
	TOTAL SHRUB	100%	16.0	14.1	
LUPIN	lupine spp.	50%	1.0	.0	deep rooted soil builder, nitrogen fixer
	TOTAL HERB	100%	.5	.7	
CAREX	sedge spp.	100%	2.0	1.4	be aware of long-stolon sedge
JUNCU	rush spp.	50%	1.0	.0	usually wet indicator
LUHI	smooth woodrush	50%	1.0	0	shaded, cool, moist woods
	TOTAL GRASS	100%	2.5	2.1	

**MOUNTAIN HEMLOCK / GROUSE HUCKLEBERRY / DEPAUPERATE**  
*Tsuga mertensiana* / *Vaccinium scoparium* / *Depauperate*  
**TSME/VASC/Dep**

**EXTENT:** This Association occurs on the Diamond Lake and Prospect Ranger Districts on pumice/ash in the High Cascades Subprovince. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** Mountain hemlock is the most outstanding feature of the overstory on flat or shallowly sloped terrain. Only rarely is it absent. Shasta red fir and lodgepole pine are common in the overstory and understory. Grouse huckleberry is the dominant shrub. Common prince's-pine is often present and pinemat manzanita is only found on shallow, rocky or pumice soils. **TSME/VASC/Dep** can be differentiated from **TSME-ABLA2/VASC** by the lack of subalpine fir. The depauperate herb layer differentiates **TSME/VASC/Dep** from the rest of the associations in the Series. **TSME/VASC** is found on the Winema National Forest (Hopkins 1979) on basaltic soils where long stolon sedge is a barrier to regeneration. It is also found on the Wallowa-Wheeler (Johnson and Simon 1987), the Willamette (Hemstrom et al. 1982), the Mt. Hood (Brockway, et al. 1983) and the central Oregon pumice zone of the Fremont, Deschutes and Winema National Forests (Volland 1976).

**ABIOTIC ENVIRONMENT:** Soils are mostly derived from pyroclastic material, pumice and ash, and roots penetrate to over 50 inches. Most of the absorbing roots are in the top few inches; feeder roots are shallow while tap roots are deep. Occasionally, a shallow layer of ash or pumice covers a developed basaltic soil. If roots reach the buried soil, growth increase is usually evident and sometimes dramatic. Ash soils in the area have a low cation exchange capacity and organic matter content, averaging (N=10) 1.7 percent litter. Pumice can hold significant amounts of water, though in aerial deposited pumice, particle bridging may act as a physical barrier to limit root proliferation and decrease availability of water (Cochran 1971). Heat capacities are low. Organic matter is a key factor as it increases water holding capacity, heat capacity, and cation exchange capacity. Topography is generally flat or shallowly sloped and in many cases collects cold air. Basal area is high with lodgepole pine, but site productivity is low.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5550.0	722.0
Aspect (deg)	241.8	80.3
Slope (%)	12.1	12.4
Total soil depth (in)	41.7	10.7
Rooting depth (in)	49.6	1.0
Total basal area (ft <sup>2</sup> /ac)	257.5	106.1

**CLIMATE:** Spring radiation frost is common; low temperatures are the most limiting factor for growth and survival. However, moisture stress can also slow growth rates. Damaging drought can occur in early June.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	40.3	0.3
Maximum month temp (F)	71.9	0.1
Mean annual ppt (in)	63.7	4.4
Dry season ppt (in)	8.1	.8

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	93.7	13.7
Moss (%)	.8	1.8
Bareground (%)	.0	.0
Gravel (%)	2.1	1.6
Rock (%)	5.1	14.1
Bedrock (%)	.0	.0

**VEGETATION:** Mountain hemlock is dominant, but lodgepole pine and Shasta red fir are common components; Douglas-fir and western white pine are occasional. The understory tree layer is variable. It may support any of the trees mentioned above as well as Pacific silver fir and white fir. Golden chinquapin may be found on the rockier sites, ridgetops, or successional stands. Grouse huckleberry dominates the shrub layer, particularly on flat, moist sites. Pinemat manzanita and common prince's-pine are common. The herbaceous layer is sparse

with some herbs and grass (likes) present, but they are neither consistent nor significant in occurrence.

**SILVICULTURE:** Disturbance of the soil surface layers can have long term effects. Most of the available nutrients (except for those cycled internally) are stored in the top 8 inches. Yarding and site preparation activities that displace or remove the top layers decrease the site's potential for supporting a commercial crop. Since cold is the most limiting factor affecting survival and growth, manipulation of heat storage and flow is often critical for successful regeneration. Trees, live or dead, standing or down, rocks, and intact soil act as effective heat sinks. Leaving an overstory will reduce the loss of heat from the site depending on the amount and distribution of canopy left. For lightly disturbed soils with shelterwood or heavier overstory, mountain hemlock, white fir, golden chinquapin, and western white pine are appropriate for regeneration. Lodgepole pine, mountain hemlock, and western white pine seem to do well in the open and on disturbed sites. Douglas-fir is at the limits of its elevation range. If planted, mortality will be high. Long-stolon sedge, an aggressive mat-forming stoloniferous plant, can be a barrier to reforestation. It is stimulated by soils disturbance from logging or underburning. Productivity is slightly below average for the TSME Series.

**WATERSHED MANAGEMENT:** Most precipitation is in the form of snow. Soils are well-drained, developed from basalt/andesite or pumice/ash. The basaltic horizons are stable and have relatively large water holding capacities. The pyroclastic soils may hold significant amounts of moisture in the subsurface layers that is difficult for the plants to tap. Pyroclastic soils are also subject to erosion. However, the terrain is generally flat or gently sloped. Summer water yields are partly dependent on snowpacks that remain well into summer. Attempts have been

made to arrange cutting patterns to increase the pack and retard its melt but the results have been mixed (Troendle and Meiman 1984).

**FIRE MANAGEMENT:** Fire occurs infrequently. Mountain hemlock and Shasta red fir, which are easily killed or scarred by fire, are mostly free of damage. Many stands, some over 320 years old, have no outward evidence of fire. Scars are infrequently found on a few trees in a limited area, likely the result of a low intensity, localized, lightning fire. Fire spread is limited by low fine fuel loadings, high moisture content (slow drying), and cool temperatures. When fires do occur they tend to be stand replacement fires that create extensive areas of even-aged lodgepole pine, or less often Shasta red fir.

**RANGE & WILDLIFE MANAGEMENT:** Although forage is essentially absent, the full-crowned conifers often provide hiding and thermal cover for big game. Small mammals and birds are primary users.

**RECREATION & VISUAL MANAGEMENT:** The flat and generally open terrain has potential for dispersed recreational activities, such as hiking and cross-country skiing. However, shallow soils, lack of plant diversity, and the cold, short growing season create a fragile environment. Disturbed topsoil or harshly treated areas will heal slowly and scars are long evident. Roadside stabilization is sometimes a problem. Cutbanks can be planted with lodgepole pine, lupines, pinemat manzanita, and long-stolon sedge, which is not aggressive unless mechanically disturbed.

Many stands are uniform in size, extensive (see the section on fire above) and lack visual variety. However, they often blanket the lower slopes of the Cascade volcanoes. Human activities often stand out.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABMAS	Shasta red fir	62%	16.0	6.5	excellent growth, good producer
PICO	lodgepole pine	50%	6.8	4.3	good soil stabilizer
PIMO	western white pine	37%	16.7	12.6	good pioneer, fast grower
PSME	Douglas-fir	37%	9.7	9.0	common, named after David Douglas
TSME	mountain hemlock	87%	38.6	13.1	retains live crown in high density
	TOTAL OVERSTORY	100%	57.0	11.6	
	---CONIFERS---				
ABAM	Pacific silver fir	12%	2.0	.0	common in northern Area 5
ABCO	white fir	37%	9.0	3.6	generalist, efficient at mid-seral stages
ABMAS	Shasta red fir	75%	11.2	6.8	provides good thermal cover
PICO	lodgepole pine	62%	6.8	5.7	quickly produces heavy fuels
PIMO	western white pine	75%	4.3	2.1	tolerant when young
PSME	Douglas-fir	37%	4.7	4.7	generalist, pioneer
TSME	mountain hemlock	100%	30.6	17.2	climax, prolific seeder
	---HARDWOODS---				
CACH	golden chinquapin	12%	2.0	.0	indicates shallow, rocky soils
	TOTAL UNDERSTORY	100%	52.1	30.4	
ARNE	pinemat manzanita	62%	19.0	21.6	pioneer on pumice
BENE	dwarf Oregongrape	12%	1.0	.0	state shrub
CEPR	squaw carpet	12%	2.0	.0	good ground cover
CHME	little prince's-pine	12%	10.0	.0	red-stemmed, small
CHUM	common prince's-pine	75%	8.5	11.9	green-stemmed, larger
PAMY	Oregon boxwood	25%	4.0	1.4	small rust colored flowers
RIVI	sticky currant	12%	1.0	.0	sticky leaves
VASC	grouse huckleberry	75%	23.0	16.7	occurs on cold, wet sites
	TOTAL SHRUB	100%	38.2	24.7	
EPAN	fireweed	12%	1.0	.0	pioneer with high nutrient demand
FRVEB	woods strawberry	12%	1.0	.0	poor fruit producer
PYPI	whitevein pyrola	12%	1.0	.0	looks like rattlesnake plantain
PYSE	one-sided pyrola	25%	1.0	.0	all flowers twisted to one side of stem
	TOTAL HERB	100%	.6	.9	
CAREX	sedge spp.	12%	2.0	0	completely occupies disturbed sites
CAPE5	long-stolon sedge	25%	1.0	0	
JUPA	Parry's rush	12%	1.0	.0	
SITAN	squirreltail spp.	12%	1.0	.0	
STIPA	needlegrass spp.	12%	1.0	.0	
	TOTAL GRASS	100%	.8	1.4	

**MOUNTAIN HEMLOCK / COMMON PRINCE'S-PINE / WESTERN TWINFLOWER**  
*Tsuga mertensiana* / *Chimaphila umbellata* / *Linnaea borealis longiflora*  
**TSME/CHUM/LIBOL**

**EXTENT:** This Association occurs on the Diamond Lake Ranger District, on pumice of the High Cascades Subprovince. N = 5 plots.

**IDENTIFYING CHARACTERISTICS:** Mountain hemlock, western white pine and Douglas-fir are common in the overstory. The understory is dominated by mountain hemlock but includes a mix of white fir, Shasta red fir, western white pine and Douglas-fir. Common prince's-pine and grouse huckleberry are found in the shrub layer. The herb layer is dominated by western twinflower. **TSME/CHUM/LIBOL** lacks Pacific rhododendron and Pacific silver fir, thus separating it from **TSME-ABAM/RHMA**. **TSME/CHUM/LIBOL** also lacks high covers of thin-leaved huckleberry and grouse huckleberry which are indicative of the other Associations in the Series. The dominance of mountain hemlock in the understory differentiates **TSME/CHUM/LIBOL** from **ABCO-TSME/VAME**.

**ABIOTIC ENVIRONMENT:** Soils are usually ash or pumice and vary in depth to over 50 inches. Being coarse, infertile pyroclastics, they have low heat capacities. Pumice can hold significant amounts of water, though in aerial deposited pumice, particle bridging may act as a physical barrier to limit root proliferation and decrease availability of water (Cochran 1971). Untimely fertilization can have little effect as there is the potential for loss of nutrients from the rooting zone as well as immobilization within the rooting zone (Cochran 1989). Maintaining cover that cycles organic material into the soil increases heat and water storage and cation exchange capacity. Soil structure, an important part of potential productivity, should be maintained. Slopes are generally flat and cold air can collect. Plant composition indicates humidity is often high.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4964.0	367.0
Aspect (deg)	15.8	95.5
Slope (%)	10.6	5.6
Total soil depth (in)	43.9	13.5
Rooting depth (in)	43.96	13.5
Total basal area (ft <sup>2</sup> /ac)	224.0	99.4

**CLIMATE:**

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.2	.9
Maximum month temp (F)	74.8	1.4
Mean annual ppt (in)	64.0	4.2
Dry season ppt (in)	8.0	1.0

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	83.6	20.1
Moss (%)	18.4	23.9
Bareground (%)	1.0	1.4
Gravel (%)	.4	.9
Rock (%)	4.0	5.5
Bedrock (%)	.0	.0

**VEGETATION:** The mountain hemlock, western white pine and Douglas-fir mixture is the most outstanding characteristic of the overstory. Lodgepole pine and Shasta red fir are much less common and sometimes absent. White fir and Englemann spruce are occasional. Mountain hemlock and white fir are abundant in the understory with Shasta red fir, western white pine, Douglas-fir and golden chinquapin common. Grouse huckleberry, common prince's pine and dwarf bramble are constantly present. Total herb cover is high with western twinflower dominant and northwest listera, one-sided pyrola, white trillium, threeleaf anemone and stream violet found on most sites.

**SILVICULTURE:** Any of the nine species that occur in the Association are appropriate for regeneration. Each has its most appropriate use. Englemann spruce, for example, survives and grows well in moist, cold concavities and riparian sites. Conversely, lodgepole pine, Douglas-fir, and western white pine will perform well on disturbed sites. The opportunity for matching species to microsites are many. In areas where the pre-harvest herbaceous cover is high and post-harvest disturbance is low,

mountain hemlock, Shasta red fir, Pacific silver fir, white fir, and some Douglas-fir may volunteer.

None of the shrubs are known as fierce competitors. Temperatures may be more limiting than the site-stored, limited resources such as water and chemicals.

**WATERSHED MANAGEMENT:** Much of the precipitation is snow. Summer rains are less frequent, although at times intense. Most often they do not fully recharge a depleted soil reservoir. Although the unweathered pumice/ash of the subsurface may hold water at low tensions, the interlocking of the rough, gravel sized pumice may act as a physical barrier to limit root proliferation and decrease water availability to the plants. Soils are usually well-drained, developed from pumice or ash, and are easily eroded. However, the terrain is generally flat or gently sloped, and watersheds are small in area, lessening the potential for erosion. Hydrophobic layers, as a result of burning, can decrease infiltration significantly. These soils which are usually fully charged in the spring, may be totally dry and dusty as they emerge from under the winter's snowpack. Mountain hemlock stands store snow well into the growing season. Summer water yields are partly dependent on that pack. Attempts have been made to arrange cutting patterns to increase the pack and retard its melt (Troendle and Meiman 1984). Growth rates are slow, thus, vegetation recovery is slow. Maintaining healthy native vegetation is the best defense against erosion or sedimentation. Stream violet, western twinflower, queen's cup, threeleaf anemone, white trillium, vanilla leaf, Columbia brome, dwarf bramble, and Pacific blackberry all have potential for revegetating disturbed sites.

**FIRE MANAGEMENT:** Evidence of fire was found in 2 of the 5 sample plots. The period between fires is not specifically known, but it is at least 135 years. The average stand was probably fire generated by intensive fires feeding on long term accumulation of fuels. The pattern seems to be frequent, but local-

ized occurrences ignited by lightning and a more longterm regime of infrequent, intense, extensive events during extreme weather periods where accumulations of dry fuels were available. Fuels at these high elevations dry slowly, but about half the sites are on south aspects, which are fairly productive.

Regenerating trees provide a fuel ladder in older stands, but Douglas-fir provides the majority of large downed fuels, and a majority of the snags. Dried herbaceous species and Douglas-fir needles are common fine fuels. Except for sites on south aspects, production of fuels is relatively slow. There are no specific volatile plants; grasses are present but rare and low in cover and volume.

**RANGE & WILDLIFE MANAGEMENT:** Old, unmanaged stands have a variety of vertical structure: old mature, limby trees, snags, various sizes of regeneration of several different species, and a low shrub layer. They usually lack a hardwood layer. Golden chinquapin is common but usually low in cover and stature. Downed logs are common; root wads are less common. Hiding and thermal cover are spotty but not rare. Cone seeds, berries, and forage are plentiful, winter browse is limited. Most of the forage is herbaceous, grasses are rare.

**RECREATION & VISUAL MANAGEMENT:** The average slope is 14 percent, rarely above 35 percent, and the terrain is not difficult to traverse. Summer temperatures can be cold and midsummer snows are occasional. The potential for dispersed recreational activities, such as hiking, cross-country skiing, birding, and hunting is high. However, fragile pumice soils and the cold, short growing season slow revegetation on disturbed sites. Compaction of developed recreation sites would decrease plant growth.

Roadside stabilization is sometimes a problem. Cutbanks can be planted with lodgepole pine, lupines, pinemat manzanita, and long-stolon sedge.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	20%	40.0	0	cone has no bracts
ABMAS	Shasta red fir	40%	30.0	28.3	excellent volume producer
PIEN	Engelmann spruce	20%	40.0	.0	indicates cold, moist drainages
PICO	lodgepole pine	40%	5.0	.0	will grow on any soil
PIMO	western white pine	60%	7.7	6.4	
PSME	Douglas-fir	60%	23.3	7.6	warmer sites
TSME	mountain hemlock	80%	10.0	5.8	
	TOTAL OVERSTORY	100%	56.6	16.3	
	—CONIFERS—				
ABCO	white fir	80%	11.7	9.1	susceptible to disease if damaged
ABMAS	Shasta red fir	60%	8.0	4.4	occurs on south slope at high elevation
PIEN	Engelmann spruce	20%	5.0	.0	plant in moist areas
PICO	lodgepole pine	20%	7.0	.0	pioneer, plant on cold sites
PIMO	western white pine	60%	8.3	4.7	intermediate in light tolerance
PSME	Douglas-fir	60%	5.3	4.0	
TSHE	western hemlock	20%	12.0	.0	
TSME	mountain hemlock	100%	31.6	12.1	cold sites
	—HARDWOODS—				
CACH	golden chinquapin	60%	4.0	5.2	
	TOTAL UNDERSTORY	100%	61.2	12.7	
ARNE	pinemat manzanita	20%	2.0	.0	provides cover on pumice soils
BENE	dwarf Oregon grape	40%	3.0	2.8	indicates deep soils
CHUM	common prince's-pine	100%	13.4	11.2	
GAOV	slender salal	40%	11.5	12.0	usually occurs on shallow soils
PAMY	Oregon boxwood	40%	11.0	12.7	
RIBES	currant spp.	20%	1.0	0	
RIVI	sticky currant	40%	1.0	0	
RULA	dwarf bramble	80%	2.5	1.7	
RUPA	thimbleberry	20%	1.0	0	usually indicates moist sites
RUUR	Pacific blackberry	40%	1.0	.0	persistent ground cover
VAME	thin-leaved huckleberry	40%	2.0	1.4	good fruit producer in the open
VASC	grouse huckleberry	100%	5.2	3.5	indicates cold, wet site
	TOTAL SHRUB	100%	33.2	18.8	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	60%	3.0	3.5	
ANDE	threeleaf anemone	80%	2.3	1.0	
ANLY2	Lyall anemone	60%	1.0	.0	
APAN	spreading dogbane	20%	2.0	.0	
AQFO	Sitka columbine	20%	1.0	.0	
CASC2	rough harebell	40%	1.0	.0	
CLUN	queen's cup	60%	4.0	1.7	
COMA3	spotted coral-root	20%	1.0	.0	
FRVEB	woods strawberry	60%	1.0	.0	
GAAP	catchweed bedstraw	20%	1.0	.0	
GOOB	rattlesnake-plantain	60%	1.0	.0	
HIAL	white-flowered hawkweed	40%	1.0	.0	
LIBOL	western twinflower	100%	23.2	21.6	
LICA3	northwest listera	80%	1.0	.0	
MEPL	broadleaved bluebells	20%	2.0	.0	
OSCH	mountain sweet-root	20%	2.0	.0	
PERA	leafy lousewort	20%	2.0	.0	
PRVU	self-heal	20%	1.0	.0	
PTAQ	bracken	20%	4.0	.0	
PYAP	leafless pyrola	20%	1.0	.0	
PYAS	alpine pyrola	20%	1.0	.0	
PYPI	whitevein pyrola	20%	1.0	.0	
PYSE	one-sided pyrola	80%	1.3	.5	
SMST	starry Solomon-plume	20%	1.0	.0	
TROV	white trillium	80%	1.0	.0	
VECA	Calif. false hellebore	20%	5.0	.0	
VIGL	stream violet	100%	1.6	.9	
	TOTAL HERB	100%	40.8	33.3	
AGROS		20%	1.0	.0	
AIPR	early hairgrass	20%	1.0	.0	
BRER	meadow brome	40%	1.5	.7	
BRVU	Columbia brome	20%	2.0	.0	
CACA	bluejoint reedgrass	20%	1.0	.0	
ELGL	blue wildrye	20%	1.0	.0	
	TOTAL GRASS	100%	1.8	2.5	



**MOUNTAIN HEMLOCK - SHASTA RED FIR / THIN-LEAVED HUCKLEBERRY**  
*Tsuga mertensiana* - *Abies magnifica shastensis* / *Vaccinium membranaceum*  
**TSME-ABMAS/VAME**

**EXTENT:** This Association occurs mostly in the Western Cascades from southwest Oregon to Washington. N = 12 plots.

**IDENTIFYING CHARACTERISTICS:** The prominence of the Shasta red fir overstory is the most outstanding identifying characteristic. Mountain hemlock occurs sporadically in the overstory, but not on all sites. However, it is the dominant feature in the understory. Shasta red fir, western white pine and white fir are common understory species. The shrub layer is well developed with thin-leaved huckleberry averaging about 57 percent. Common prince's-pine, northwest listera and one-sided pyrola are usually present. This association occurs widely. The presence of Shasta red fir in the overstory and understory combined with the high cover of thin-leaved huckleberry separates this association from the others in the Series. **TSME/VAME** is found on the Mt. Baker-Snoqualmie (Henderson and Peter 1981) but it has abundant Pacific silver fir which is absent in this Association. **TSME/VAME/XETE** is found on the Willamette, Mt. Hood (Hemstrom et al. 1987), and Gifford Pinchot (Brockway et al. 1983) National Forests. Again, Pacific silver fir is frequently found in the understory and overstory and the total shrub cover is higher than **TSME-ABMAS/VAME**. It is similar to **TSME/VAME** described by Johnson and Simon (1987) that occurs in the Wallowa-Whitman National Forest. The Wallowa-Whitman Association is found at slightly higher elevations with subalpine fir occasionally in the overstory and common in the understory.

**ABIOTIC ENVIRONMENT:** Cold temperature is the most limiting environmental factor. Soil temperatures limit water uptake in the spring, and frost often affects survival and growth. Water can be limiting late in the growing season, depending on soil depth, coarse fragment content, texture, aspect, and slope position. Parent material is either basalt or pyroclastic material. Soils on basalt are usually shallow and rocky, although on some sites they are over 50 inches deep. Most have good water holding capacity. Basaltic sites are generally more fertile than pumice or ash.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5437.0	330.0
Aspect (deg)	332.8	87.1
Slope (%)	22.3	14.4
Total soil depth (in)	38.1	15.6
Rooting depth (in)	46.4	8.3
Total basal area (ft <sup>2</sup> /ac)	270.8	67.9

**CLIMATE:**

CLIMATE	MEAN	S.D.
Mean annual temp (C)	40.9	1.0
Maximum month temp(C)	72.8	1.4
Mean annual ppt (in)	60.8	6.3
Dry season ppt (in)	8.3	1.0

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	91.9	7.6
Moss (%)	5.1	5.6
Bareground (%)	2.6	5.1
Gravel (%)	.7	.7
Rock (%)	6.0	6.9
Bedrock (%)	.9	2.9

**VEGETATION:** Shasta red fir and mountain hemlock, the most visible species in the stand, will continue to co-occur through succession. During warmer climatic sequences, Shasta red fir regeneration will be favored along with white fir and Douglas-fir. If the parent rock is pumice, western white pine will have a competitive advantage. A string of cold years will favor mountain hemlock and western white pine. The shrub layer is dominated by thin-leaved huckleberry with common prince's-pine, and dwarf bramble common. The herb layer is diverse compared to the other associations in the series. The are over 20 species. Queen's cup, leafy lousewort, white trillium and one-sided pyrola are the most common.

**SILVICULTURE:** Shasta red fir is the best producer of the nine conifers that occur in the Association. Any of which would be appropriate for stand regeneration. There are many opportunities for matching species to microsite. Where harvesting enhances the extremes in temperature, mountain hemlock, western white pine, incense-cedar, Shasta red fir, white fir and Douglas-fir (in order of resistance) are all appropriate selections. Extreme care must be taken, however, when using sugar pine. It is adapted to the warmest sites in the series. Deep soils and western twinflower indicates potential for its use. The potential for natural regeneration may also be explored. In areas where pre-harvest herbaceous cover is high and post-harvest disturbance is low, mountain hemlock, Shasta red fir, incense-cedar, white fir, and some Douglas-fir may volunteer.

Although none of the shrubs are known as fierce competitors, thin-leaved huckleberry is abundant, averages 57 percent cover, and may provide competition for moisture during dry years. However, thin-leaved huckleberry does not perform well when initially exposed to full sunlight, particularly after harvest activities.

**WATERSHED MANAGEMENT:** Much of the precipitation (average annual precipitation is approximately 60 inches) is snow. It remains well into the growing season. Cutting practices may enhance the amount stored (Troendle and Meiman 1984). Summer precipitation averages about 8 inches. Thundershowers are the major source. Soils are well-drained, developed from basalt/andesite or pumice/ash. Basaltic horizons are stable and have relatively large water holding capacities. Pyroclastic layers will not hold significant amounts of moisture and are subject to erosion. Maintenance of cover, litter and soil structure on pumice/ash soils are critical for water yields. The Association is usually found on midslope positions or benches with slopes ranging from 0 to over 50 percent.

Herbaceous cover is average for the association, but shrub cover is relatively high. Growth rates are slow and disturbed sites are slow to recover, particularly on pumice/ash soils. In addition to the native trees, Pacific blackberry and dwarf bramble could be used to revegetate disturbed sites.

**FIRE MANAGEMENT:** The weather is cold and moist much of the year. Fuels dry slowly and light-

ning is usually accompanied by thundershowers. Fuel production is low. The dominant trees are shade tolerant, retain their needles and branches, and remain suppressed for long periods of time before dying, and adding fuels to the forest floor. Evidence of fire was found in 3 of the 12 sample plots. Fire may often occur as a result of a lightning strike, but it usually quickly dies without leaving evidence. Occasionally (probably less frequently than 150 years) an extensive fire occurs as a result of long term accumulation of fuels coinciding with an unusually dry year or series of dry years.

**RANGE & WILDLIFE MANAGEMENT:** Old, unmanaged stands have a variety of vertical structure; old mature, limby trees, snags, various sizes of regeneration of several different species, and a low shrub layer. Golden chinquapin is the only hardwood present but its occurrence is sporadic and cover is low. Downed logs are common; root wads are less common. Hiding and thermal cover are spotty but not rare. Cone seeds, berries, and forage are plentiful, winter browse is limited. Most of the forage is herbaceous, grasses are rare.

In terms of livestock forage, herbage production is low and water sources are scarce. The season would be short (the snow lingers most springs) and the soils are delicate. Continual movement would be needed to avoid overuse and prevent soil damage.

**RECREATION & VISUAL MANAGEMENT:** The terrain is gentle. Slope averages about 22 percent. Slope lengths are long, but not highly dissected. Sites usually occur on midslope positions and seldom in riparian positions. Huckleberry production is negatively related to overstory cover. Gentle burning and stand tending can enhance huckleberry production. The potential for hiking, skiing, birding, and foraging is high. The climate can be hostile, even in the summer. Midsummer snows can be dangerous for the unprepared.

Cutbanks can be stabilized with trailing blackberry, columbia brome, golden chinquapin, and western twinflower. Western twinflower is mat-forming and can tolerate poor soils. Beargrass has real potential for cutbank stabilization, but little is known about its propagation. It is being used quite heavily for weaving of novelty items. Propagation may take some of the pressure off the natural populations and provide resilient cover for cutbanks and fill slopes.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	41%	5.8	3.4	best volume producer  found in moist areas adapted to warmest sites in the series  established in protected conditions warmer conditions
ABMAS	Shasta red fir	100%	33.7	12.9	
CADE3	incense-cedar	8%	5.0	.0	
PIEN	Engelmann spruce	8%	10.0	.0	
PILA	sugar pine	8%	5.0	.0	
PIMO	western white pine	33%	9.8	6.7	
PSME	Douglas-fir	16%	12.5	3.5	
TSHE	western hemlock	8%	5.0	.0	
TSME	mountain hemlock	75%	13.9	12.2	
	TOTAL OVERSTORY	100%	53.9	14.5	
	---CONIFERS---				
ABCO	white fir	75%	8.0	4.0	regeneration favored during warmer periods
ABMAS	Shasta red fir	100%	9.5	6.9	regeneration favored during warmer periods
PIEN	Engelmann spruce	8%	2.0	.0	plant in wet areas
PILA	sugar pine	8%	5.0	.0	at the upper end of its range
PIMO	western white pine	58%	3.6	2.6	if pumice, competitive advantage
PSME	Douglas-fir	8%	25.0	0	regeneration favored during warmer periods
TSHE	western hemlock	8%	15.0	0	
TSME	mountain hemlock	100%	32.9	11.6	dominant feature in understory
	---HARDWOODS---				
ACGL	Douglas maple	16%	10.0	0	
CACH	golden chinquapin	25%	27.7	23.6	cutbank stabilizer
	TOTAL UNDERSTORY	100%	63.0	26.3	
AMAL	western serviceberry	25%	1.7	1.2	poor, cool sites indicates moderate conditions drier sites indicates moist conditions  revegetates disturbed sites revegetates disturbed sites  competition for moisture during dry years
ARNE	pinemat manzanita	16%	6.0	1.4	
BENE	dwarf Oregon grape	50%	5.5	5.1	
CHUM	common prince's-pine	75%	10.4	8.1	
PAMY	Oregon boxwood	41%	1.0	.0	
RIBES	currant spp.	16%	7.0	7.1	
RILO	gummy gooseberry	16%	5.5	3.5	
RIVI	sticky currant	8%	5.0	.0	
RULA	dwarf bramble	41%	4.8	3.3	
RUUR	Pacific blackberry	8%	1.0	0	
SOSI	Sitka mountain-ash	8%	1.0	.0	
VAME	thin-leaved huckleberry	100%	56.7	24.9	
	TOTAL SHRUB	100%	73.7	25.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	25%	7.0	5.0	indicates potential for sugar pine
ANDE	threeleaf anemone	33%	3.0	1.6	
ANLY2	Lyal anemone	16%	1.0	.0	
ARMA3	bigleaf sandwort	41%	1.0	0	
CASC2	rough harebell	16%	1.5	.7	
CLUN	queen's cup	58%	2.4	1.1	
COMA3	spotted coral-root	8%	1.0	.0	
COME	Pacific coral-root	16%	1.0	.0	
COST2	hooded coral-root	33%	1.0	.0	
DIFO	Pacific bleedingheart	25%	1.3	.6	
DIHOO	Oregon fairybell	25%	1.0	.0	
EPAN	fireweed	8%	1.0	.0	
ERPU	shaggy fleabane	8%	2.0	.0	
FRVEB	woods strawberry	8%	2.0	.0	
GAOR	Oregon bedstraw	16%	2.0	.0	
GOOB	rattlesnake-plantain	33%	1.0	.0	
HAL	white-flowered hawkweed	25%	1.0	.0	
LIBOL	western twinflower	25%	8.3	5.8	
LICA3	northwest listera	75%	1.1	3	
MECI	ciliate bluebells	8%	2.0	.0	
MEPA	tail bluebells	8%	1.0	.0	
MOSI	candyflower	8%	1.0	.0	
OSCH	mountain sweet-root	16%	2.0	0	
PERA	leafy lousewort	50%	1.3	.8	
PHHEP	varileaf phacelia	8%	1.0	0	
POMU	western sword-fern	8%	1.0	.0	
PTAQ	bracken	8%	1.0	.0	
PTAN	woodland pinedrops	8%	1.0	.0	
PYPI	whitevein pyrola	16%	1.0	0	
PYSE	one-sided pyrola	75%	2.0	1.7	
SETR	arrowleaf groundsel	8%	1.0	.0	
SMRA	western false Solomon's-seal	8%	2.0	0	
SMST	starry Solomon-plume	25%	2.7	2.1	
SYRE	snow-queen	8%	6.0	.0	
TITR	foamflower	8%	5.0	.0	
TRLA2	western starflower	8%	2.0	.0	
TROV	white trillium	50%	1.2	.4	
VASI	mountain heliotrope	16%	1.0	.0	
VAHE	white inside-out-fir	33%	3.0	1.8	
VECA	Calif. false hellebore	8%	1.0	.0	
VIGL	stream violet	41%	1.0	.0	
VIOR2	round-leaved violet	8%	1.0	.0	
XETE	common beargrass	8%	1.0	0	
	TOTAL HERB	100%	18.7	19.5	
BROMU	brome spp.	16%	1.0	.0	
BRVU	Columbia brome	8%	1.0	.0	
CAREX	sedge spp.	25%	1.3	.6	
DACA4	California oatgrass	8%	5.0	0	
MESU	Alaska oniongrass	16%	1.0	0	
	TOTAL GRASS	100%	1.2	.8	

**MOUNTAIN HEMLOCK - PACIFIC SILVER FIR / PACIFIC RHODODENDRON**  
*Tsuga mertensiana* - *Abies amabilis* / *Rhododendron macrophyllum*  
**TSME-ABAM/RHMA**

**EXTENT:** This Association occurs on northerly latitudes on the Western Cascade volcanics and on scattered, cold slopes. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** The **TSME-ABAM/RHMA** Association occurs in cold pockets at relatively low elevations, on steep slopes near ridges, or upper slopes at higher elevations. Soils and parent materials vary but produce more biomass than the other associations in the Series. Pacific silver fir is common in the overstory and understory. The shrub layer, usually with high cover of Pacific rhododendron, is the most distinguishing characteristic. Beargrass is the most common herb. The **ABAM/RHMA/XETE** occurs on the Willamette National Forest (Hemstrom et al. 1982), mostly on the adjacent Rigdon Ranger District. It is very similar floristically to **TSME-ABAM/RHMA**, however, Pacific silver fir is dominant in the understory of **ABAM/RHMA/XETE**.

**ABIOTIC ENVIRONMENT:** Golden chinquapin usually indicates shallow soils. It occurs on ridgetops and intensely disturbed sites like skid-trails and old landings. Soil temperatures, which can be low all through the growing season, limit water uptake. At temperatures near freezing the viscosity of water increases and slows uptake. Reduced biological activity at low temperatures reduces decomposition rates. The presence of Pacific silver fir indicates cool but productive sites.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4990.0	374.0
Aspect (deg)	1.6	107.1
Slope (%)	26.5	22.8
Total soil depth (in)	33.3	11.6
Rooting depth (in)	42.7	9.0
Total basal area (ft <sup>2</sup> /ac)	340.0	312.8

**CLIMATE:** Although this is the warmest association of the Series, volume production is more often limited by temperature than moisture. Frost can kill regeneration where cold air collects, particularly Douglas-fir and white fir. The presence of thin-

leaved huckleberry indicates cold. Sites with salal are the driest.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.2	1.2
Maximum month temp(F)	74.6	1.6
Mean annual ppt (in)	66.7	5.8
Dry season ppt (in)	8.3	1.2

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	95.7	4.3
Moss (%)	2.5	1.9
Bareground (%)	1.0	1.2
Gravel (%)	2.0	2.2
Rock (%)	1.3	1.0
Bedrock (%)	.0	.0

**VEGETATION:** Although mountain hemlock is dominant, there is an even mixture of Douglas-fir, Pacific silver fir, western white pine, and Shasta red fir in the overstory. Mountain hemlock and Pacific silver fir dominate the understory. Pacific rhododendron usually clogs the shrub layer and inhibits tree regeneration under canopy gaps. Few if any other shrubs can compete. Dwarf bramble is sparse when present, but beargrass can dominate the herb layer.

**SILVICULTURE:** On the coldest sites mountain hemlock, western white pine, and Pacific Silver fir are the heartiest species. On moderate sites, small units, or partial harvest conditions, where extreme cold is not a problem, Shasta red fir, Douglas-fir, and western white pine will be the best producers.

Both Pacific rhododendron and beargrass can be barriers to planting even after harvest and burning. Site preparation measures may be necessary where cover is high. They can also be competitive. Neither species is a fast grower particularly after being disturbed by harvest activities. A thorough evaluation of possible volume loss may indicate treatment. On moist sites Pacific rhododendron can

act as a nurse crop if its cover is less than 30 percent cover.

**WATERSHED MANAGEMENT:** Soils, mostly basalts and andesites, are porous but sometimes shallow. Temperatures are cold and snow is retained late into the spring and early summer. Vegetation is slow to recover after a disturbance, but shrub cover is high. If problem erosion is anticipated, it would be far better to keep existing cover rather than attempt reestablishment. Pacific rhododendron, the major shrub, is difficult to root, replant or seed. Beargrass plugs may have potential and trailing blackberry is well known as a fast growing generalist.

**FIRE MANAGEMENT:** Evidence of fire was found in 1 of the 3 sample plots. The frequency is well over 100 years. The average stand, over 100 years old, was probably fire generated by intense fires feeding on long-term accumulation of fuels. The pattern seems to be frequent localized occurrences ignited by lightning and infrequent, intense, extensive events during extreme weather periods. Because this Association tends to occur at high elevations, on north aspects, and in frost pockets, fuels dry slowly.

Douglas-fir provides the majority of coarse downed fuels. Herbaceous cover is low and fine fuels are

mostly mats of Pacific rhododendron leaves. Pacific rhododendron does provide continuous, uniform, but non-volatile fuels. Vertical distribution is broken. Production of fuels is relatively slow, but so is decomposition.

**RANGE & WILDLIFE MANAGEMENT:** Pacific rhododendron may provide hiding cover in some stands, but it provides little forage or mast. Herbaceous production is low and what little there is, (beargrass) is nonpalatable. Open water is not readily available.

**RECREATION & VISUAL MANAGEMENT:** Huckleberry production is negatively related to overstory cover. Vine maple can provide bright red fall color. Even summer temperatures can be cold, midsummer snows are occasional.

Most stands are uniform and lack variety but may occasionally be associated with ridgetop rock outcroppings.

Cutbanks can be stabilized with trailing blackberry, vine maple (which is slow to root), golden chinquapin, and western twinflower. Western twinflower is mat-forming and can tolerate soils with poor nutrition. Beargrass is a resilient species, but little is known about its propagation.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	50%	7.5	3.5	hearty on cold sites, co-climax species
ABMAS	Shasta red fir	50%	8.5	2.1	good producer on warmer sites
PIMO	western white pine	100%	4.8	.5	frost tolerant
PSME	Douglas-fir	100%	21.2	14.9	pioneer after disturbance
TSME	mountain hemlock	75%	41.7	27.5	hearty on cold sites, climax species
	TOTAL OVERSTORY	100%	65.2	20.0	
ABAM	—CONIFERS— Pacific silver fir	75%	7.0	7.2	regenerates on colder sites
ABCO	white fir	25%	3.0	.0	regenerates on warmer sites
ABMAS	Shasta red fir	25%	5.0	.0	
PIMO	western white pine	25%	5.0	0	intermediate in light tolerance
PSME	Douglas-fir	25%	2.0	0	
TSME	mountain hemlock	100%	15.0	9.1	climax species
	—HARDWOODS—				
ACCI	vine maple	25%	1.0	.0	bright red fall color
CACH	golden chinquapin	50%	11.0	12.7	indicates shallow soils
	TOTAL UNDERSTORY	100%	29.7	16.0	
AMAL	western serviceberry	25%	1.0	0	
ARNE	pinemat manzanita	25%	3.0	0	pioneer species, drier sites
CHUM	common prince's-pine	25%	2.0	.0	green-stemmed
GAOV	slender salal	25%	1.0	0	indicates dry site
PAMY	Oregon boxwood	25%	1.0	.0	cool sites
RHMA	Pacific rhododendron	100%	80.0	21.2	inhibits tree regeneration under canopy gaps
RULA	dwarf bramble	50%	2.5	.7	
RUUR	Pacific blackberry	25%	1.0	.0	
SOSI	Sitka mountain-ash	25%	1.0	0	
VAME	thin-leaved huckleberry	75%	15.0	13.2	indicates cold
VAPA	red huckleberry	25%	2.0	.0	cool, moist sites
VASC	grouse huckleberry	25%	1.0	0	cold, flat, moist sites
	TOTAL SHRUB	100%	95.7	24.3	
HIAL	white-flowered hawkweed	25%	1.0	0	
LIBOL	western twinflower	25%	3.0	0	cutbank stabilizer
PERA	leafy lousewort	25%	1.0	0	
PYAS	alpine pyrola	25%	2.0	0	
PYPI	whitevein pyrola	25%	1.0	.0	
TROV	white trillium	25%	1.0	.0	
VIGL	stream violet	25%	1.0	.0	
VIOR2	round-leaved violet	25%	1.0	.0	
XETE	common beargrass	75%	43.3	17.6	dominates herb layer, barrier to planting
	TOTAL HERB	100%	35.2	25.1	
	TOTAL GRASS	100%	.0	.0	

## LODGEPOLE PINE SERIES

*Pinus contorta*

### PICO

Lodgepole pine grows throughout the western United States in a wide variety of environments. Known for its ability to pioneer disturbed sites and tolerate cold and infertile soils, it is often found on recent lava flows, high elevation pumice or ash, and in concavities or where cold air tends to collect.

In southwest Oregon it may occur as a pioneer on deep soils, but is usually succeeded by more tolerant and efficient species. It behaves as the fireweed of tree species. It seeds in quickly, forming dense stands after disturbance, has high demand for mineralized nutrients, and produces biomass at a high rate. Unlike fireweed, an on-site seed source needs to be present.

Although lodgepole pine has a high demand for nutrients, it tends to cycle what it absorbs by dropping needles and branches, rather than cycling internally. The process enriches the forest floor preparing the site for other species. Thus, it tends to be a good nurse crop, but it is not the most efficient species for retaining and using the site's resources in the long run. In most cases a mix of species produces much more biomass than a monoculture.

### THE SERIES

**EXTENT:** The Lodgepole Pine Series occurs on the Umpqua and Rogue River National Forests, within the the Diamond Lake and Prospect Ranger Districts in the High Cascade Subprovince. Isolated pockets occur in the Sky Lakes Wilderness. It is also common on the Winema National Forest where the associations tend to reflect colder, dryer environments. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** Associations occur between 3400 and 6400 feet in elevation, on shallow slopes (usually less than 5 percent) and pumice/ash flats. They are dominated by lodgepole pine and support lesser amounts of Shasta red fir or mountain hemlock in the understory. Scattered Douglas-fir, white fir, western white pine, and a few other tree species may also be present. Shrubs and herbs are low in abundance or rare.

Because lodgepole pine is such an aggressive pioneer, it may be difficult to identify the Series when keying young stands (20-30 years after a disturbance). Successional processes are slow in the extreme climate, and lodgepole pine may remain the dominant understory species for a third of the bio-

logical rotation. But mountain hemlock and Shasta red fir will gradually take over in their habitat. When you are in doubt about the series, slope, parent rock, elevation, and topographic position will help to discriminate between Series.

**ABIOTIC ENVIRONMENT:** Parent rock is pumice or ash. Fragment size and depth decreases with increasing distance from Crater Lake (Mt. Mazama was the ash source on most sites). Soils generally are shallow, infertile, and erodable.

Two million year old, well developed, fertile, basaltic soils were buried by pumice and ash during the eruption. In most cases the buried profile is too deep for tree roots to reach. However, where the new pumice is shallow and the buried soil is accessed, growth dramatically increases. **Site evaluation should include an intensive look at the soil.**

Soil and air temperatures limit survival and growth (refer to the discussion on pumice/ash soils in the High Cascade Province description: page 11).



ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	3420	5380	1960	4656.0	653.0	higher than population average
Aspect (deg)	--	--	--	340.1	86.1	north-northwest with a lot of variation
Slope (%)	0	5	5	2.3	1.8	lowest of all Series
Total soil depth (in)	22.8	50.0	27.2	38.6	14.3	slightly less than population average
Rooting depth (in)	39.4	50.0	10.6	48.5	4.0	highest of all Series
Total basal area (ft <sup>2</sup> /ac)	45	170	125	126.4	45.3	lowest of all Series

**CLIMATE:** The Lodgepole Pine Series are colder than the average for the Cascade Province due to

their location on broad flats where cold air collects (Figure 9).

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	41.2	46.4	5.2	43.1	1.8	below population average
Max monthly temp (F)	73.0	81.0	8.0	76.0	2.6	below population average
Mean annual ppt (in)	60	65	5	63.6	2.4	above population average
Dry season ppt (in)	7	9	2	8.0	.6	same as population average

**FOREST FLOOR:** Litter cover is slightly above average due to the cold temperatures slowing the rate

of decay. Moss cover is also minimized by the cold temperatures.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	80	100	20	93.4	6.9	higher than the population average
Moss (%)	0	5	5	1.6	1.9	lowest of all Series
Bareground (%)	0	15	15	3.9	5.3	
Gravel (%)	0	15	15	4.1	5.0	
Rock (%)	0	2	2	.3	.8	
Bedrock (%)	0	0	0	.0	.0	

**VEGETATION:** Lodgepole pine and Shasta red fir indicate the opposite extremes in environment within the Series. Lodgepole pine indicates limiting soil and air temperatures and a short growing season. Since lodgepole pine also pioneers disturbed sites, its presence may indicate recent disturbance rather than low site quality. But, it consistently indicates cold. On the other extreme, Shasta red fir is positively related to site productivity. Its presence indicates the more productive sites of the Series. The presence of mountain hemlock indicates intermediate conditions. Pinemat manzanita indicates rocky surface soils or soils with high coarse fragment content and grouse huckleberry indicates wet soils. Both shrub and herb cover are typically low.

**SILVICULTURE:** Cold soils and frost are the most limiting factors for growth and survival (see the discussion in the subprovince section). Reforestation is difficult and growth rates are usually below commercial levels. Frost occurs throughout the Province and can limit survival in a number of plant associations. The Lodgepole Series is the most severely

affected. Most Districts have compiled frost occurrence maps including indications of severity and depth. Check the frost occurrence maps on your District, but be assured that the Lodgepole Pine Series is frost prone.

Stocking level control is usually needed to maintain a healthy stand. Naturally generated lodgepole stands are usually thick, stagnant, and subject to insect infestation. Heavy fuel loads can be produced as suppressed trees die or as a result of insect damage. Thus, a significant amount of energy is needed to maintain healthy, fire proof stands which have a relatively low timber value. Ignoring these stands means accepting accumulating fuel loads, periodic fires and insect epidemics.

Gophers have been a major antagonist to seedling establishment. Although they are a major soil building agent, they can reduce stocking to unsatisfactory levels. The level of reduction depends partly on the population level. Yet, it seems a few hungry gophers can destroy a plantation, and total control

is next to impossible. Population levels are related to food and habitat availability and predation. They prefer fleshy roots such as bulbs, tubers, and corms to tree roots. However, providing such food as an alternate source tends to increase population levels and damage levels. Owls, coyotes, and martins are important predators. They tend to prefer closed forests; gophers prefer open habitat. Generally, keeping cutting units small or closed in structure, tends to favor the predators and reduce the amount of gopher habitat. Clear-cutting while eliminating food sources has had some success, but it requires intensive use of herbicides to maintain low food levels.

**WATERSHED MANAGEMENT:** A high percentage of the annual precipitation falls as snow and lasts well into the spring.

Sites are slow to naturally revegetate after disturbance. Exposed soils heal slowly and are subject to erosion. Lodgepole pine can provide some cover and stability. Wild seedlings are in supply and can be easily transplanted. They represent a genetic line that survived the on-site environmental extremes and are already preconditioned to the local climate. Pinemat and greenleaf manzanita may also

be used to provide cover. Naturals should be considered for rehabilitation efforts whenever possible.

**FIRE MANAGEMENT:** Underburning is not common in the Series in general, though as one moves east and the precipitation diminishes, fire frequency increases. Stand replacement fires (the characteristic regime) are related to declining vigor, accumulation of fuels and insect attacks.

**RANGE AND WILDLIFE MANAGEMENT:** Most stands are not inherently diverse. Young fire generated stands are often uniform in spacing and vertical structure (not the best form to slow fires). Habitat diversity increases with age, is probably minimal at canopy closure and tends to increase again as the suppressed trees die and fall. Diversity may be enhanced by leaving thickets and breaking up the uniformity.

**RECREATION AND VISUAL MANAGEMENT:** The Series provides opportunities for dispersed recreation and winter sports. Current recreational use is high. Sites are often used for cross-country skiing, snowmobiling, snowshoeing, and sledding. Camping and hiking are popular during the summer.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABCO	white fir	14%	15	15	0	15.0	.0	
PICO	lodgepole pine	85%	25	50	25	38.3	10.3	
PIMO	western white pine	28%	5	10	5	7.5	3.5	
PSME	Douglas-fir	14%	12	12	0	12.0	.0	
	TOTAL OVERSTORY	100%	25	60	35	38.9	12.3	
ABCO	—CONIFERS—							
	white fir	42%	2	25	23	11.7	11.9	
ABMAS	Shasta red fir	42%	1	1	0	1.0	.0	
PICO	lodgepole pine	100%	15	70	55	47.0	17.7	
PIMO	western white pine	28%	4	10	6	7.0	4.2	
PSME	Douglas-fir	28%	5	10	5	7.5	3.5	
TSME	mountain hemlock	71%	1	10	9	3.2	3.9	
	—HARDWOODS—							
CACH	golden chinquapin	14%	1	1	0	1.0	.0	
	TOTAL UNDERSTORY	100%	15	108	93	58.9	28.0	
ARNE	pinemat manzanita	57%	8	75	67	34.5	30.3	
CEPR	squaw carpet	14%	16	16	0	16.0	.0	
CHUM	common prince's-pine	28%	1	1	0	1.0	.0	
CHNA	common rabbit-brush	28%	1	4	3	2.5	2.1	
PAMY	Oregon boxwood	14%	5	5	0	5.0	.0	
RIBES	currant spp.	28%	1	2	1	1.5	.7	
ROGY	baldhip rose	14%	3	3	0	3.0	.0	
VASC	grouse huckleberry	28%	1	8	7	4.5	4.9	
	TOTAL SHRUB	100%	0	83	83	25.7	30.5	
ARENA		28%	1	2	1	1.5	.7	
FRVEB	woods strawberry	28%	1	3	2	2.0	1.4	
HAL	white-flowered hawkweed	14%	1	1	0	1.0	.0	
IRIS	iris spp.	14%	2	2	0	2.0	.0	
LUPIN	lupine spp.	28%	12	15	3	13.5	2.1	
LUBI	two-colored lupine	14%	1	1	0	1.0	.0	
PHDI	spreading phlox	14%	10	10	0	10.0	.0	
POTEN		28%	3	25	22	14.0	15.6	
PTAN	woodland pinedrops	28%	1	1	0	1.0	.0	
	TOTAL HERB	100%	0	74	74	13.4	27.6	
AGROS		14%	2	2	0	2.0	.0	
CAPE5	long-stolon sedge	42%	1	1	0	1.0	.0	
ELGL	blue wildrye	28%	1	1	0	1.0	.0	
SIHY	bottlebrush squirreltail	28%	1	1	0	1.0	.0	
STLE2	Lemmon's needlegrass	28%	1	1	0	1.0	.0	
STOC	western needlegrass	14%	1	1	0	1.0	.0	
	TOTAL GRASS	100%	0	6	6	1.9	2.0	

## LODGEPOLE PINE KEY

- 1a Pinemat manzanita [ARNE] present.
- 1b Pinemat manzanita [ARNE] absent.

PICO/ARNE/LUPIN  
PICO-TSME/CAPE5

## LODGEPOLE PINE ASSOCIATIONS

PICO-TSME/CAPE5 pg. 59	Lodgepole pine - mountain hemlock / Long-stolon sedge <i>Pinus contorta</i> - <i>Tsuga mertensiana</i> / <i>Carex pensylvanica</i>
PICO/ARNE/LUPIN pg. 62	Lodgepole pine / Pinemat manzanita / Lupine <i>Pinus contorta</i> / <i>Arcotostaphylos nevadensis</i> / <i>Lupinus</i>

**LODGEPOLE PINE - MOUNTAIN HEMLOCK / LONG STOLON SEDGE**  
*Pinus contorta* - *Tsuga mertensiana* / *Carex pensylvanica*  
**PICO-TSME/CAPE5**

**EXTENT:** This Association occurs on the Butte Falls and Prospect Ranger Districts of the Rogue River National Forest in the High Cascade Subprovince. N = 3 plots.

**IDENTIFYING**

**CHARACTERIS-**

**TICS:** **PICO-TSME/CAPE5** occurs on pumice/ash flats above 4500 feet in elevation or in depressions, at lower elevations, that collect cold air. Lodgepole pine is always present and dominant, but there are few associated shrubs or herbs. Greenleaf manzanita may be present and abundant on disturbed sites. **PICO-TSME/CAPE5** is distinguishable from **PICO/ARNE/LUPIN** by its lack of shrubs, herbs, and grasses and the **ABCO-PICO/AMAL** by the presence of mountain hemlock, shasta red fir, and white fir. Winema National Forest Associations, **PICO/FORB**, **PICO/VACCINIUM/FORB**, and **PICO/VASC/CAPE5** have higher shrub, herb and grass cover and occur on basalts and andesites. **PICO/CAPE5/LUPIN**, described in Volland's guide (Volland 1976) for the Pumice Zone is most similar. But it supports a different complement of species and is colder and dryer than the **PICO-TSME/CAPE5**.

**ABIOTIC ENVIRONMENT:** Parent rock is young Mazama pumice and ash. Soils are correspondingly young and shallow, often sandy, and generally infertile. Cobbles, pushed to the surface by frost heaving, are common.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5183.0	224.0
Aspect (deg)	32.9	103.0
Slope (%)	2.3	1.5
Total soil depth (in)	32.4	15.2
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	125.0	69.5

**CLIMATE:** Temperatures are cold during the growing season and frost may occur anytime of year. Soil surface temperatures are cold and fluctuate widely. Average precipitation is about 60 inches with approximately 10 inches falling during the growing season. Although the growing season is short,

moisture stress can develop early in the growing season (see the discussion on high elevation pumice soils in the subprovince section). The environment is more extreme than the **PICO/ARNE/LUPIN** Association.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	41.7	6
Maximum month temp(F)	73.9	.9
Mean annual ppt (in)	63.3	2.9
Dry season ppt (in)	8.0	1.0

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	98.7	2.3
Moss (%)	1.0	1.7
Bareground (%)	.7	1.2
Gravel (%)	5.7	8.1
Rock (%)	.0	0
Bedrock (%)	.0	0

**VEGETATION:** Lodgepole pine dominates the site. Shasta red fir and mountain hemlock may be present in varying amounts. They regenerate during warmer years but are not able to survive frost during the seedling stage. Lodgepole pine is the most likely species to pioneer disturbed sites. When it is associated with stoloniferous sedges, reforestation can be difficult. The sedge is a physical barrier and competes for nutrients and water as well. Prompt reforestation and reducing the severity of disturbance lessen the dominance of sedge and reduce reforestation problems.

**SILVICULTURE:** On most sites it would be difficult to grow anything but lodgepole pine to rotation age. Mountain hemlock may survive on the best sites, but growth would be extremely slow (even for mountain hemlock). It seems the cost of practicing intensive forest management in this Association would be high, but returns would be low. These sites require some stand tending if they are to remain healthy. Western pine beetle populations tend

to reach epidemic levels in stagnated stands and/or when weather cycles produce stress. On the east side of the Cascades, where underburning has historically maintained low stand densities, individual trees tend to have high carbohydrate reserves which help ward-off epidemics. If high density stands are ignored (not managed) then periodic epidemics will follow.

Soil disturbance, whatever the cause, site preparation or burning, results in the stimulation of long stolon sedge. If regeneration of trees is an objective, disturbing the soil surface can be counterproductive. Long-stolon sedge forms thick resilient mats of roots and sod that dominate the soil surface for years. Deep plowing, an expensive activity, breaks-up the mats allowing planting and gives new seedlings a chance, but does not kill the sedge.

**WATERSHED MANAGEMENT:** Annual precipitation averages about 60 inches with 7-10 inches falling between May and September. A high percentage falls as snow which lasts well into spring. Soils are coarse with a low water holding capacity and erosion potential is high. Pumice and ash are well known for becoming hydrophobic, particularly after burning. Rather than absorbing water, they repel it, and can be dry and dusty even after the snow melts off in the spring. Each year after spring rains, sediment loads are high. Occasionally streams appear chalky. Lupines, cinquefoil, long-stolon sedge, pinemat manzanita, and lodgepole pine are excellent species to use for revegetation activities.

**FIRE MANAGEMENT:** Underburning is not common in the series in general. Only one of the three

sampled stands was burned. It was 140 years old. Unlike lodgepole pine at lower elevations on east-side where the fire free period is less than two decades, the fire free period may last through a biological rotation. Stand replacement fires (the characteristic regime) are related to declining vigor, accumulation of fuels, and insect attacks. Fire could be used to control stocking levels, fuels, and vigor. Crater Lake National Park personnel have had some experience with such a strategy on the eastern edge of the Park where fire is more common in seral lodgepole stands.

Fuel accumulates, and decomposes slowly. Accumulation increases after stand closure as suppressed individuals die and fall, and at biological rotation when the stand begins to fall apart. Decomposition rates increase with increasing ground contact. Sales, thinning, and firewood gathering may be prescribed to reduce risk by reducing loads and creating breaks.

**RANGE & WILDLIFE MANAGEMENT:** The potential for range use is low. Forage production is low, except for sedge, and the length of the grazing season would be short. Stands lack variability in composition and structure. Diversity increases with age, but opportunities for enhancement may be found when prescribing resource activities.

**RECREATION & VISUAL MANAGEMENT:** Stands are typical, monotonous High Cascade upperslope forests with no special characteristics. They provide solitude, cool hiking weather, birding, hunting, and a view of the alpine peaks, and the opportunity for winter sports.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PICO	lodgepole pine TOTAL OVERSTORY	100% 100%	41.7 41.7	7.6 7.6	pioneers disturbed sites, watch stoloniferous grasses
ABMAS PICO TSME CACH	—CONIFERS— Shasta red fir lodgepole pine mountain hemlock —HARDWOODS— golden chinquapin TOTAL UNDERSTORY	66% 100% 66% 33% 100%	1.0 36.7 5.5 1.0 41.0	.0 20.2 6.4 .0 22.7	regenerate during warmer years, seedlings frost intolerant frost tolerant regenerate during warmer years, seedlings frost intolerant not tolerant of cold pockets
CHUM VASC	common prince's-pine grouse huckleberry TOTAL SHRUB	33% 33% 100%	1.0 1.0 .3	.0 .0 .6	low productivity
LUBI	two-colored lupine TOTAL HERB	33% 100%	1.0 .3	.0 .6	excellent for revegetation
CAPE5 STLE2 STOC	long-stolon sedge Lemmon's needlegrass western needlegrass TOTAL GRASS	100% 33% 33% 100%	1.0 1.0 1.0 1.3	.0 .0 .0 .6	forms thick resilient mats of roots

**LODGEPOLE PINE / PINEMAT MANZANITA / LUPINE**  
*Pinus contorta* / *Arctostaphylos nevadensis* / *Lupinus*  
**PICO/ARNE/LUPIN**

**EXTENT:** This Association occurs on the Diamond Lake Ranger District of the Umpqua National Forest and the Prospect Ranger District of the Rogue River National Forest in the High Cascade Subprovinces of the Umpqua and Rogue Basins. It is likely to be present in the Sky Lakes Wilderness and the Winema National Forest. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** The most striking feature is its lack of vegetation; productive sites are almost barren (from a west-sider's point of view). Slopes are usually flat or concave. Soils are derived from pumice or ash and remain cold much of the year. Most sites occur above 4000 feet in elevation. The PICO/ARCTO (Volland 1976) and the PICO/FORB (Hopkins 1979) are similar in appearance, but differ in plant composition. Pinemat manzanita is the most evident ground vegetation in the PICO/ARNE/LUPIN, but common elements can be found in all three associations although management limitations and recommendations are slightly different.

**ABIOTIC ENVIRONMENT:** The parent rock is 7000 year old Mazama ash with young, poorly developed, infertile, shallow soils. The surface is usually cobbly, bare, and lacks organic materials. Cold temperatures (soil and air) slow all biological processes; thus, decomposition and incorporation of organic matter is slow. Topography is gentle to flat with occasional concavities that effectively trap cold air.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4260.0	577.0
Aspect (deg)	326.1	68.4
Slope (%)	2.3	2.2
Total soil depth (in)	43.2	13.6
Rooting depth (in)	47.3	5.3
Total basal area (ft <sup>2</sup> /ac)	127.5	29.9

**CLIMATE:** Temperature is the most limiting factor for growth and survival. Soil fertility is a close second. The growing season is short, it starts late and ends early because of frost. Moisture can be limiting during dry summers. Soils dry quickly and without the usual thundershowers, moisture stress develops.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.2	1.5
Maximum month temp(F)	77.6	2.3
Mean annual ppt (in)	63.7	2.5
Dry season ppt (in)	8.0	.0

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	89.5	6.7
Moss (%)	2.0	2.2
Bareground (%)	6.3	6.1
Gravel (%)	3.0	1.4
Rock (%)	.5	1.0
Bedrock (%)	.0	.0

**VEGETATION:** Lodgepole pine dominates the site, but mountain hemlock, Shasta red fir, western white pine, white fir, and even Douglas-fir may occasionally be present. White fir and Douglas-fir occur on the warmer sites and mountain hemlock and western white pine on the colder sites. Site productivity influences species diversity. The poorer sites are less diverse. Pinemat manzanita is by far the most abundant shrub, but occasionally squaw carpet may be more abundant. Lupine is the most abundant herb and often is associated with scattered composites. Lodgepole pine will regenerate well after disturbance, except in the cold air pockets where temperature extremes can significantly reduce seedling survival. Both pinemat manzanita and squaw carpet are pioneers.

**SILVICULTURE:** Natural regeneration with lodgepole pine is possible after light disturbance as long as a seed source is present. Mountain hemlock regenerates well in areas influenced by edge effect. Scattered survivors of white fir, western white pine, and Douglas-fir always seem to be present in natural stands generated by fire. Abundance of regeneration is likely related to intensity of disturbance. Lodgepole is apt to occur on severely disturbed sites followed in abundance by Shasta red fir, western white pine, white fir, mountain hemlock,



and Douglas-fir. More naturals are consistently found on the least disturbed sites with the exception of lodgepole pine. Mixing and placement of artificial regeneration should follow the same strategy used to provide for naturals, i.e., a prescription that minimizes extremes in temperature, and maintains soil structure and fertility.

Timber volume production is low. Total biomass production is low. Yet cost of harvest operations can be low if tractors are used. However, tractor use often results in extensive soil disturbance and site damage, a serious detriment to regeneration and subsequent growth.

Shrub competition is not usually a problem, although greenleaf manzanita can dominate for several decades after severe disturbance. It isn't difficult to create dense stands of greenleaf manzanita. Snowbrush is sometimes a sleeper, with seeds stored in the soil, but only on the lowest and most fertile sites of the Association. Overstocked stands are common and thinning is often needed to maintain resistance to insect attack. Historically fire has thinned stands, but it is not likely that it also totally eliminated epidemics in the natural system. Our strategy should be to accept some degree of insect activity, fire, and stagnation, yet thin and mind the fuels in areas where healthy stands are valued.

**WATERSHED MANAGEMENT:** PICO/ARNE/LUPIN is at the cold end of the temperature gradient. A high percentage of precipitation falls as snow and remains into summer on north facing slopes. Total precipitation averages between 60 and 70 inches per year. Thundershowers, as much as 22 percent of the total annual, can be intense, isolated events. The pumice/ash often lacks vegetative cover, is sometimes hydrophobic, and consequently infiltration can be slow and erosion potential high. Vegetation is slow to reestablish on disturbed sites. Lupines, cinquefoil, pinemat manzanita, squawcarpet, and lodgepole pine can be used to stabilize disturbed sites. Much needs to be learned about when and how to use native plants for stabilization and revegetation.

**FIRE MANAGEMENT:** There is a strong moisture gradient (a rainshadow effect) west to east along the Cascade crest. Fire regimes vary greatly according to position along the gradient at the crest. About half of the stands underburn during a biological rotation. Our eastern-most stands can burn as frequently as every 20 years. Western stands may develop without fire for hundreds of years into somewhat uneven-aged lodgepole stands with heavy fuels. When ignition occurs, intense, extensive burns result. Fuel accumulates slowly in young stands. The closed canopy blocks the sun, allows the snow to remain longer, and keeps the top layers of soil frozen into spring. As the canopy begins to deteriorate, the sun reaches the forest floor and the temperature regime changes. Between 90 and 120 years, the stands fall apart or may be attacked by insects, and the rate of fuel accumulation rises. Strong winds are common in the area as a reaction to the differences in temperature and pressure between the west and east side of the Cascades. Flat terrain lowers resistance to control, but access is often limited near the crest.

**RANGE & WILDLIFE MANAGEMENT:** Biomass production is low, not much browse or forage is produced and streams are uncommon. Hiding and thermal cover is far less common than in other associations, although there is enough diversity in structure that occasional patches can be found. Berry producing species are rare, and the ground is frozen much of the year (a poor environment for microorganisms). Plant species diversity is low.

**RECREATION & VISUAL MANAGEMENT:** Snow and flat terrain provide opportunities for winter sports. The open stand structure does have an aesthetic appeal and provides views of the mountain peaks. Soils are fragile and even limited summer use can damage site productivity. Rehabilitation may require a scheduled cycling of use among several sites or Areas may be sacrificed or designated for continuous heavy use. Creative use of natives (plants) can help control traffic, limit damage, dampen sound, limit visibility, and rehabilitate overused areas.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	25%	15.0	.0	warmer sites, co-climax
PICO	lodgepole pine	75%	35.0	13.2	climax species
PIMO	western white pine	50%	7.5	3.5	colder sites
PSME	Douglas-fir	25%	12.0	.0	warmer sites
	TOTAL OVERSTORY	100%	36.7	15.8	
	—CONIFERS—				
ABCO	white fir	75%	11.7	11.9	stable, even, protected conditions
ABMAS	Shasta red fir	25%	1.0	.0	pioneer after disturbance
PICO	lodgepole pine	100%	54.7	13.0	regenerates well after disturbance
PIMO	western white pine	50%	7.0	4.2	intermediate in light tolerance
PSME	Douglas-fir	50%	7.5	3.5	
TSME	mountain hemlock	75%	1.7	1.2	regenerates well in areas with edge effect
	TOTAL UNDERSTORY	100%	72.2	25.9	
ARNE	pinemat manzanita	100%	34.5	30.3	pioneer
CEPR	squaw carpet	25%	16.0	.0	pioneer
CHUM	common prince's-pine	25%	1.0	.0	
CHNA	common rabbit-brush	50%	2.5	2.1	
PAMY	Oregon boxwood	25%	5.0	.0	cool sites
RIBES	currant spp.	50%	1.5	.7	
ROGY	baldhip rose	25%	3.0	.0	moist to dry
VASC	grouse huckleberry	25%	8.0	.0	cold, flat, moist soils
	TOTAL SHRUB	100%	44.7	27.1	
ARENA		50%	1.5	.7	
FRVEB	woods strawberry	50%	2.0	1.4	
HIAL	white-flowered hawkweed	25%	1.0	.0	
IRIS	iris spp.	25%	2.0	.0	
LUPIN	lupine spp.	50%	13.5	2.1	soil stabilizer
PHDI	spreading phlox	25%	10.0	.0	
POTEN		50%	14.0	15.6	
PTAN	woodland pinedrops	50%	1.0	.0	
	TOTAL HERB	100%	23.2	35.0	
AGROS		25%	2.0	.0	
ELGL	blue wildrye	50%	1.0	.0	
SIHY	bottlebrush squirreltail	50%	1.0	.0	
STLE2	Lemmon's needlegrass	25%	1.0	.0	
	TOTAL GRASS	100%	2.3	2.6	

## PACIFIC SILVER FIR SERIES

*Abies amabilis*

### ABAM

Pacific silver fir (*Abies amabilis*) grows along the Pacific coast in Canada, and at the upper elevations of the Washington and Oregon Cascades. There are isolated stands in the Klamath Geological Province in southern Oregon and northern California on north aspects in coves. It is a slow growing species with low economic value. It is a shade tolerant climax or co-climax and may be found associated with most tree species found in the southern Cascades.

### THE SERIES

**EXTENT:** The Series occurs on the Umpqua and northern most Rogue River National Forests. It occurs on Western Cascade parent rock in the Umpqua basin. It is rarely found in the Rogue River Basin. The Series increases in importance northward. Hemstrom et al. (1987) has described 17 associations that occur in the Willamette National Forest. N = 36 plots.

**IDENTIFYING CHARACTERISTICS:** There are no outstanding identifying characteristics. Identifica-

tion is based on the subtle changes in cover of pacific silver fir in the regeneration layer. Topographical and vegetational characteristics overlap with other Series. The Series occurs on a variety of well drained soils.

**ABIOTIC ENVIRONMENT:** Parent rock is usually basalt or andesite, but can also be any type of pyroclastic rock.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	4100	6120	2020	5036.0	455.0	above population average
Aspect (deg)	—	—	—	347.1	86.7	north-northwest with a lot of variation
Slope (%)	3	70	67	26.7	16.3	slightly below population average
Total soil depth (in)	11.8	50.0	38.2	43.5	10.0	above population average
Rooting depth (in)	19.7	50.0	30.3	47.9	6.0	above population average
Total basal area (ft <sup>2</sup> /ac)	120	520	400	336.6	95.1	highest of all Series

**CLIMATE:** The dominant environment is cool and wet (Figure 9). Stands occur where the mean temperature is 42 degrees F. Frost can limit survival and low temperatures limit growth, decomposition, and

incorporation of organic matter. Moisture stress develops late in the growing season if at all.

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	39.2	44.6	5.4	41.9	1.2	below population average
Maximum month temp (F)	70.2	78.3	8.1	74.4	1.8	below population average
Mean annual ppt (in)	60	80	20	67.2	6.8	highest for all Series
Dry season ppt (in)	8	11	3	9.8	0.7	highest for all Series

**FOREST FLOOR:**

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	67	100	33	95.3	6.4	highest of all Series below population average
Moss (%)	0	75	75	6.8	15.4	
Bareground (%)	0	8	8	.6	1.6	
Gravel (%)	0	8	8	.8	1.5	
Rock (%)	0	25	25	2.6	4.5	
Bedrock (%)	0	5	5	.4	1.2	

**VEGETATION:** Western Hemlock, Shasta red fir, mountain hemlock, and Douglas-fir are common associates. Western hemlock is found on the most productive sites of the Series. Mountain hemlock is found on the coldest sites and Douglas-fir is usually a persistent seral species with little indicator value. Thin-leaved huckleberry is the most constant shrub associate; dwarf Oregongrape, grouse huckleberry, and dwarf bramble are common Series associates. Queen's cup, starry false Solomon's-seal, and foam-flower are the most commonly found herbs.

**SILVICULTURE:** Cold soils and frost are the most limiting factors for growth and survival. Understory light levels may seriously limit growth, but individuals may survive for over 100 years and still release. Pacific silver fir grows well in full sunlight, but it is seldom the major species chosen for regeneration, because of its low value and susceptibility to rot if injured.

Shrub competition is not usually a problem. Occasionally Pacific rhododendron, snowbrush, or blue blossom may affect crop tree growth. With Pacific rhododendron, preharvest covers of greater than about 30 percent indicate the potential for crop-tree growth loss. Snowbrush or blue blossom may not be present in an uncut stand, particularly if it has been undisturbed for over 30 years. Potential for competition from these species may be indicated by occasional stems on cutbanks, harvest units, or fill-slopes nearby, or there may be no indication at all. Seeds stored in the soil remain viable for over 100 years and are stimulated by fire and less so by other types of disturbance.

As stands age, Pacific silver fir becomes increasingly common. It is a tolerant species that can cre-

ate a fuel ladder to the overstory yet is easily killed by fire through the sapling stage. Underburning could be used to change the distribution of fuels and eliminate silver fir. Stands and soils are usually moist into the summer and consumption of coarse wood could be kept low. Burning may also help to exhaust the supply of ceanothus seed in the soil and create some browse during mid seral stages. Overall the potential for severe fire and heavy competition from ceanothus species may be reduced by a program of underburning.

**WATERSHED MANAGEMENT:** A high percentage of precipitation falls as snow and remains into summer on north facing slopes. The relatively deep soils absorb moisture and hold it into the spring. The coldest sites (usually less than 10 percent herbaceous cover) are slow to naturally revegetate after disturbance. Western fescue or red fescue can be used to provide soil surface protection and forage.

**FIRE MANAGEMENT:** The fire regime is similar to the mid Cascades. Underburning is not common. Stands burn infrequently, but severely.

**RANGE AND WILDLIFE MANAGEMENT:** Forage production is generally low. Structural diversity, increasing with succession provides average habitat breadth. Leaving a variety of species to provide hard and soft snags will increase niche diversity.

**RECREATION AND VISUAL MANAGEMENT:** Visual resources are average for general forest and lack special character. The berry crops may attract gatherers in the fall during productive years.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	72%	1	60	59	16.4	15.0	
ABCO	white fir	16%	2	40	38	12.0	14.1	
ABMAS	Shasta red fir	77%	1	75	74	28.3	21.1	
PIEN	Engelmann spruce	2%	7	7	0	7.0	.0	
PIMO	western white pine	33%	2	15	13	5.6	3.6	
PSME	Douglas-fir	58%	3	65	62	30.0	21.9	
TSHE	western hemlock	25%	2	73	71	21.7	22.7	
TSME	mountain hemlock	44%	3	60	57	25.9	19.0	
	TOTAL OVERSTORY	100%	30	98	68	72.4	13.4	
	---CONIFERS---							
ABAM	Pacific silver fir	100%	5	80	75	37.3	20.3	
ABCO	white fir	33%	2	20	18	8.9	5.0	
ABMAS	Shasta red fir	19%	3	35	32	12.1	11.0	
CHNO	Alaska-cedar	2%	1	1	0	1.0	.0	
PIEN	Engelmann spruce	2%	1	1	0	1.0	.0	
PICO	lodgepole pine	2%	1	1	0	1.0	.0	
PIMO	western white pine	8%	1	3	2	1.7	1.2	
PSME	Douglas-fir	5%	1	5	4	3.0	2.8	
TABR	Pacific yew	11%	1	10	9	4.3	3.9	
TSHE	western hemlock	33%	5	60	55	23.3	16.1	
TSME	mountain hemlock	44%	1	45	44	20.0	14.0	
	---HARDWOODS---							
ACCI	vine maple	22%	2	90	88	39.9	30.8	
ACGL	Douglas maple	5%	1	3	2	2.0	1.4	
CACH	golden chinquapin	2%	3	3	0	3.0	.0	
	TOTAL UNDERSTORY	100%	5	176	171	69.2	33.2	
AMAL	western serviceberry	8%	1	2	1	1.7	.6	
ARNE	pinemat manzanita	2%	3	3	0	3.0	.0	
BENE	dwarf Oregongrape	22%	1	50	49	8.6	16.8	
CHME	little prince's-pine	25%	1	7	6	1.7	2.0	
CHUM	common prince's-pine	61%	1	8	7	2.3	2.2	
COST	red-osier dogwood	2%	1	1	0	1.0	.0	
GAOV	slender salal	8%	1	1	0	1.0	.0	
GASH	salal	2%	2	2	0	2.0	.0	
HODI	creambush ocean-spray	2%	2	2	0	2.0	.0	
OECE	Indian plum	2%	1	1	0	1.0	.0	
PAMY	Oregon boxwood	22%	1	4	3	1.5	1.1	
RHMA	Pacific rhododendron	11%	1	30	29	10.0	13.4	
RILA	swamp gooseberry	22%	1	3	2	1.6	7	
RIME	prickly gooseberry	5%	1	1	0	1.0	.0	
RIVI	sticky currant	11%	1	3	2	1.8	1.0	
ROGY	baldhip rose	44%	1	4	3	1.5	8	
RULA	dwarf bramble	75%	1	4	3	1.8	.9	
RUNI	snow bramble	2%	1	1	0	1.0	.0	
RUPA	thimbleberry	5%	1	5	4	3.0	2.8	
RUSP	salmonberry	2%	1	1	0	1.0	0	
RUUR	Pacific blackberry	22%	1	7	6	2.0	2.1	
SARA	red elderberry	2%	5	5	0	5.0	.0	
SOSI	Sitka mountain-ash	11%	1	1	0	1.0	.0	
SYMO	creeping snowberry	16%	1	2	1	1.2	4	
VAME	thin-leaved huckleberry	86%	1	85	84	11.3	18.9	
VAPA	red huckleberry	8%	1	2	1	1.3	.6	
VASC	grouse huckleberry	5%	1	30	29	15.5	20.5	
WHMO	whipplevine	2%	1	1	0	1.0	.0	
	TOTAL SHRUB	100%	1	92	91	19.8	21.9	

MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	75%	1	60	59	8.1	12.7	
ACRU	baneberry	11%	1	7	6	4.0	3.5	
ADBI	trail-plant, pathfinder	27%	1	15	14	2.7	4.4	
ANMA	common pearly-everlasting	2%	1	1	0	1.0	.0	
ANDE	threeleaf anemone	47%	1	7	6	1.9	1.5	
ANLY2	Lyall anemone	13%	1	1	0	1.0	.0	
ARMA3	bigleaf sandwort	11%	1	1	0	1.0	.0	
ARCO	heart-leaf arnica	2%	2	2	0	2.0	.0	
ARLA	mountain arnica	16%	1	15	14	3.3	5.7	
ASCA3	western wild ginger	13%	1	10	9	3.2	3.9	
ASTR	maidenhair spleenwort	2%	1	1	0	1.0	.0	
ASNO	New England aster	2%	1	1	0	1.0	.0	
ASLEC	freckled milk-vetch	2%	2	2	0	2.0	.0	
CAPR3	California harebell	2%	1	1	0	1.0	.0	
CASC2	rough harebell	41%	1	5	4	1.6	1.1	
CIAL	alpine circaea	2%	1	1	0	1.0	.0	
CLUN	queen's cup	86%	1	10	9	2.7	2.3	
COMA3	spotted coral-root	13%	1	1	0	1.0	.0	
COME	Pacific coral-root	5%	1	1	0	1.0	.0	
COST2	hooded coral-root	2%	1	1	0	1.0	.0	
COCA	bunchberry	5%	1	2	1	1.5	.7	
DIFO	Pacific bleedingheart	36%	1	1	0	1.0	.0	
DIHOO	Oregon fairybell	44%	1	35	34	5.8	11.5	
ERSU2	three-veined fleabane	2%	1	1	0	1.0	.0	
FRVEB	woods strawberry	8%	1	1	0	1.0	.0	
FRUM	Umpqua fraseria	2%	1	1	0	1.0	.0	
GAAP	catchweed bedstraw	16%	1	1	0	1.0	.0	
GAOR	Oregon bedstraw	19%	1	20	19	5.1	7.3	
GATR	fragrant bedstraw	2%	1	1	0	1.0	.0	
GADI	spreading groundsmoke	2%	1	1	0	1.0	.0	
GOOB	rattlesnake-plantain	38%	1	1	0	1.0	.0	
HIAL	white-flowered hawkweed	27%	1	2	1	1.1	.3	
HYTE	Pacific waterleaf	2%	1	1	0	1.0	.0	
HYMO	fringed pinesap	5%	1	1	0	1.0	.0	
LAPO	leafy peavine	2%	1	1	0	1.0	.0	
LIAP	celery-ld licorice-rt	5%	1	1	0	1.0	.0	
LIBOL	western twinflower	25%	1	15	14	4.8	4.4	
LICA3	northwest listera	38%	1	3	2	1.2	.6	
LUAL	sickle-keeled lupine	2%	3	3	0	3.0	.0	
MIBR	Brewer's mitrewort	2%	2	2	0	2.0	.0	
MOSI	candyflower	30%	1	2	1	1.5	.5	
NEHE	small white nemophila	2%	1	1	0	1.0	.0	
OSCH	mountain sweet-root	16%	1	10	9	2.5	3.7	
OSPU	purple sweet-root	8%	1	1	0	1.0	.0	
PERA	leafy lousewort	36%	1	2	1	1.2	.4	
PHHA	whiteleaf phacelia	2%	1	1	0	1.0	.0	
PHAD	woodland phlox	8%	1	2	1	1.3	.6	
POPU	skunk-leaved polemonium	2%	1	1	0	1.0	.0	
POMU	western sword-fern	11%	1	1	0	1.0	.0	
PTAQ	bracken	19%	1	3	2	1.6	1.0	
PTAN	woodland pinedrops	2%	1	1	0	1.0	.0	
PYPI	whitevein pyrola	19%	1	1	0	1.0	.0	
PYSE	one-sided pyrola	69%	1	3	2	1.4	.6	
SEBO	Bolander's groundsel	2%	1	1	0	1.0	.0	
SMRA	western false Solomon's-seal	11%	1	1	0	1.0	.0	
SMST	starry Solomon-plume	63%	1	70	69	7.8	18.3	
SURA	buttercup-leaved suksdorfia	2%	1	1	0	1.0	.0	
SYRE	snow-queen	5%	1	2	1	1.5	.7	
TITR	foamflower	50%	1	15	14	3.7	4.1	
TRLA2	western starflower	5%	1	2	1	1.5	.7	
TROV	white trillium	61%	1	2	1	1.1	.3	
VASI	mountain heliotrope	13%	1	1	0	1.0	.0	
VAHE	white inside-out-flr	61%	1	10	9	2.2	2.0	

VECA	Calif. false hellebore	13%	1	1	0	1.0	.0
VEVI	American false hellebore	5%	1	1	0	1.0	.0
VIAM	American vetch	2%	1	1	0	1.0	.0
VIGL	stream violet	36%	1	10	9	2.2	2.4
VIOR2	round-leaved violet	36%	1	7	6	1.8	1.7
WISE	redwoods violet	13%	1	1	0	1.0	.0
XETE	common beargrass	27%	1	35	34	8.3	11.1
	TOTAL HERB	100%	0	145	145	35.4	37.4
BROMU	brome spp.	2%	3	3	0	3.0	.0
BRPA	Pacific brome	8%	1	1	0	1.0	.0
BRVU	Columbia brome	2%	1	1	0	1.0	.0
CAREX	sedge spp.	11%	1	1	0	1.0	.0
CAGE	elk sedge	5%	1	2	1	1.5	.7
CARO	Ross sedge	5%	1	1	0	1.0	.0
ELGL	blue wildrye	2%	2	2	0	2.0	.0
FEOC	western fescue	8%	1	1	0	1.0	.0
FERU	red fescue	2%	3	3	0	3.0	.0
JUNCU	rush spp.	2%	1	1	0	1.0	.0
LUCA2	tailcup lupine	5%	2	3	1	2.5	.7
LUPA	smallflowered woodrush	11%	1	1	0	1.0	.0
MESU	Alaska oniongrass	5%	1	2	1	1.5	.7
TRCA	tall trisetum	2%	1	1	0	1.0	.0
	TOTAL GRASS	100%	0	8	8	1.1	1.8

## PACIFIC SILVER FIR KEY

- 1a Vine maple [ACCI] present.  
1b Vine maple [ACCI] absent.

ABAM/ACCI/TITR  
2

- 2a Western hemlock [TSHE] present.  
2b Western hemlock [TSHE] absent.

ABAM-TSHE/CLUN  
ABAM/VAME-RULA

## PACIFIC SILVER FIR ASSOCIATIONS

ABAM/VAME-RULA pg. 71	Pacific silver fir / Thin-leaved huckleberry - Dwarf bramble <i>Abies amabilis</i> / <i>Vaccinium membranaceum</i> - <i>Rubus lasiococcus</i>
ABAM/ACCI/TITR pg. 76	Pacific silver fir / Vine maple / Foamflower <i>Abies amabilis</i> / <i>Acer circinatum</i> / <i>Tiarella trifoliata</i>
ABAM-TSHE/CLUN pg. 80	Pacific silver fir - Western hemlock / Queen's cup <i>Abies amabilis</i> - <i>Tsuga heterophylla</i> / <i>Clintonia uniflora</i>



**SILVER FIR / THIN-LEAVED HUCKLEBERRY - DWARF BRAMBLE**  
*Abies amabilis* / *Vaccinium membranaceum* - *Rubus lasiococcus*  
**ABAM/VAME-RULA**

**EXTENT:** This Association occurs on the Diamond Lake, North Umpqua, and Tiller Ranger Districts of the Umpqua National Forest. It is least common on the Tiller Ranger District. It is found in the High Cascade and Western Cascade Subprovinces of the Umpqua Basin. N = 21 plots.

**IDENTIFYING CHARACTERISTICS:** The cold environment is too harsh for western hemlock, but many of the herbs commonly found in the Cascades maintain moderate leaf area when protected by tree overstory. Sites rarely occur below 4000 feet in elevation. There are no similar east-side associations, but the **ABAM/VAME/CLUN** and **ABAM/VAME/XETE** (Hemstrom et al. 1982) are both similar in composition and occur on the neighboring Ranger Districts of the Willamette National Forest. The **ABAM/VAME/CLUN** supports western hemlock and is more productive than the **ABAM/VAME-RULA** and likely deserves separate status. A major difference between the **ABAM/VAME-RULA** and **ABAM/VAME/XETE** is the abundance of beargrass as the name implies.

**ABIOTIC ENVIRONMENT:** Basalt (basic igneous) is the most common rock type, followed by more acidic intrusives such as andesite and rhyolite. Granite, similar in composition and fertility to rhyolite, only rarely supports **ABAM/VAME-RULA**. That **ABAM/VAME-RULA** can be found on such a diversity of parent rock indicates that other environmental factors dominate and mask the differences related to soil. Soil depth ranges from 12 to 50 inches. The shallowest soils are found on rhyolite. The amount of surface rock increases with increasing slope up to 20 percent on slopes over 60 percent. Most sites are covered with duff, little bare ground is exposed. Cold soil and air temperatures are likely to be the most limiting factor for plant growth and survival. Topography varies from moderately steep to flat with occasional concavities that effectively trap cold air.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5263.0	440.0
Aspect (deg)	309.8	94.5
Slope (%)	24.0	13.3
Total soil depth (in)	40.7	11.8
Rooting depth (in)	47.0	7.4
Total basal area (ft <sup>2</sup> /ac)	360.1	90.9

**CLIMATE:** Snow accumulation averages three to six feet. Moisture stress is not likely to limit biomass production until late in the growing season when soils are warming and soil moisture is depleted.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	41.4	1.2
Maximum month temp(F)	73.5	1.8
Mean annual ppt (in)	67.9	7.5
Dry season ppt (in)	10.0	.7

**FOREST FLOOR:** The forest floor is typical of high elevation Cascade sites with high litter cover, low moss cover and very few rocks at the surface. On these colder associations, litter decomposition is slow. Several years of accumulated needles and small branches can be found.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.0	7.7
Moss (%)	2.7	3.9
Bareground (%)	.9	2.0
Gravel (%)	.8	.8
Rock (%)	3.0	5.6
Bedrock (%)	.5	1.5

**VEGETATION:** Seven tree species may be found in the overstory and nine in the understory. Because sites are transitional from the typical southwest Oregon environment to central Cascade conditions, niche variety is rich. Douglas-fir, Shasta red fir, and lodgepole pine can be residuals generated by disturbance. Silver fir, white fir, and Engelmann spruce are more related to stable, even, protected condi-

tions. Mountain hemlock, western white pine, and lodgepole pine are found on the cooler sites; Engelmann spruce is found on moist to wet sites and Douglas-fir, Shasta red fir, and white fir occupy the warmer sites. The combined total, average cover of the shrub layer is 23 percent. Thin-leaved huckleberry is by far the most dominant. The common Cascade herbs (trillium, vanillaleaf, threeleaf anemone, Scouler's harebell, queen's cup, and beargrass) are present but not usually dominating the forest floor as in other associations that occur in warmer environments.

**SILVICULTURE:** Post disturbance natural regeneration rates are slow. Seedlings often are exposed to lethal soil surface temperatures. Both frost and 100 degree F temperatures can occur within a 24 hour period. And since early growth rates are slow, and small seedlings are highly susceptible, mortality can be high. Stands over 100 years old often have advanced regeneration with Pacific silver fir as common dominant. It survives for decades in dense shade, and grows well in full sunlight after 2 to 3 years of adjustment and psychiatric help. Mountain hemlock regenerates well in areas influenced by edge effect. It tolerates low temperatures, but its thin bark does not offer much protection from high, south slope, surface temperatures once cambial growth has begun. Shasta red fir, Douglas-fir and white fir are all appropriate for regenerating warmer sites of the Association. Vanilla-leaf is a good indicator of such sites. Englemann spruce rarely occurs, but it consistently indicates wet sites and high water tables.

Timber volume production is moderate. Total biomass production is low. Western white pine has a high rate of early diameter growth, but a variety of *Ribes* species assure the presence of blister rust. Consequently rust risk is high. Shasta red fir and Pacific silver fir growth rates are slightly higher than Douglas-fir on the colder sites, but Douglas-fir does well on the warmer sites.

Shrub competition is not usually a problem, although thickets of thin-leaved huckleberry can physically interfere with planting. Snowbrush seed, stored in the soil, may produce a competitive shrub layer on the most productive sites in the Association. If there are several plants in the stand or on nearby cutbanks or harvest units, the risk of gener-

ating a *Ceanothus* patch is high. The risk increases where fire is used for site preparation or fuels management.

**WATERSHED MANAGEMENT:** A high percentage of precipitation falls as snow and remains into summer on north facing slopes. Average annual precipitation is about 68 inches. Vegetation is slow to reestablish on disturbed sites. Erosion potential varies with parent material; generalities are not applicable. Lupines, pinemat manzanita, common beargrass, western fescue, blue wildrye, red fescue, melica, and brome can be used to stabilize disturbed sites. Using native plants for stabilization and revegetation is highly recommended.

**FIRE MANAGEMENT:** Fire is not a common occurrence; less than 10 percent of the stands sampled show evidence of fire. Environmental factors, except lightning and wind, negatively affect fire. Temperatures are low, rainfall and humidity are high, productivity is moderate, decomposition rates are moderate, canopies are thick, and evaporation rates are low. Fuel moisture is likely to remain high through the summer. However, pockets of downed trees are likely to occur as a result of localized insect attacks or endemic diseases. Management of these fuel pockets should include input from wildlife biologists.

**RANGE & WILDLIFE MANAGEMENT:** Forage production is relatively high in closed canopied stands. The Association averages 25 to 30 percent cover of grasses and herbs and produces browse and berries. Forage is not available till late spring, several weeks after the snow melts. Thick patches of regeneration up to several acres in size occasionally occur. These patches provide thermal and hiding cover depending on their age and extent. Soft and hard snags are available for wildlife, grown from a variety of species over varying amounts of time. Ephemeral streams average two per half mile, thus water sources are common. With the high cover of grasses, rodents should be plentiful.

**RECREATION & VISUAL MANAGEMENT:** Unvarying forest with occasional viewpoints characterizes the Association. Soils are somewhat fragile and developed sites are slow to heal. Dispersed recreation seems to be most appropriate.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	61%	16.5	16.6	related to stable, protected areas
ABCO	white fir	9%	7.5	3.5	related to stable, protected areas
ABMAS	Shasta red fir	100%	33.8	21.4	generated by disturbance
PIEN	Engelmann spruce	4%	7.0	.0	related to stable, protected areas
PIMO	western white pine	38%	4.4	1.2	cooler sites
PSME	Douglas-fir	33%	19.7	18.9	generated by disturbance
TSME	mountain hemlock	71%	27.3	18.8	cooler sites
	TOTAL OVERSTORY	100%	72.9	10.8	
	—CONIFERS—				
ABAM	Pacific silver fir	100%	32.3	19.0	
ABCO	white fir	23%	8.4	5.0	regenerate warmer sites
ABMAS	Shasta red fir	33%	12.1	11.0	regenerate warmer sites
CHNO	Alaska-cedar	4%	1.0	.0	
PIEN	Engelmann spruce	4%	1.0	.0	plant in moist areas
PICO	lodgepole pine	4%	1.0	.0	
PIMO	western white pine	4%	3.0	.0	
PSME	Douglas-fir	9%	3.0	2.8	regenerate warmer sites
TSME	mountain hemlock	71%	21.2	13.6	regenerates well in areas with edge effect
	—HARDWOODS—				
ACGL	Douglas maple	4%	1.0	0	
	TOTAL UNDERSTORY	100%	54.1	23.8	
AMAL	western serviceberry	14%	1.7	.6	
ARNE	pinemat manzanita	4%	3.0	.0	good for stabilizing disturbed sites
BENE	dwarf Oregongrape	4%	2.0	.0	
CHME	little prince's-pine	19%	1.0	.0	
CHUM	common prince's-pine	61%	2.7	2.6	
GAOV	slender salal	9%	1.0	.0	cool, moist, mid to late successional
PAMY	Oregon boxwood	23%	1.8	1.3	
RHMA	Pacific rhododendron	4%	1.0	.0	
RILA	swamp gooseberry	9%	1.0	.0	
RIME	prickly gooseberry	9%	1.0	.0	
RIVI	sticky currant	19%	1.8	1.0	
ROGY	baldhip rose	33%	1.7	1.1	
RULA	dwarf bramble	90%	1.9	.9	cool to cold, moist sites
RUNI	snow bramble	4%	1.0	.0	
RUPA	thimbleberry	4%	1.0	.0	
RUUR	Pacific blackberry	9%	1.5	.7	
SOSI	Sitka mountain-ash	14%	1.0	0	
SYMO	creeping snowberry	9%	1.0	.0	
VAME	thin-leaved huckleberry	95%	16.1	22.2	
VAPA	red huckleberry	4%	2.0	.0	warmer sites
VASC	grouse huckleberry	9%	15.5	20.5	thickets can interfere with planting
WHMO	whipplevine	4%	1.0	.0	warmer, dry sites
	TOTAL SHRUB	100%	23.0	24.3	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	61%	9.0	16.0	indicates warmer sites
ACRU	baneberry	4%	1.0	.0	
ADBI	trail-plant, pathfinder	14%	1.0	.0	
ANMA	common pearly-everlasting	4%	1.0	.0	
ANDE	threeleaf anemone	42%	1.3	.7	
ANLY2	Lyal anemone	14%	1.0	.0	
ARMA3	bigleaf sandwort	9%	1.0	.0	
ARCO	heart-leaf arnica	4%	2.0	.0	
ARLA	mountain arnica	14%	5.7	8.1	
ASCA3	western wild ginger	4%	1.0	.0	
ASNO	New England aster	4%	1.0	.0	good for stabilizing disturbed sites good for stabilizing disturbed sites
ASLEC	freckled milk-vetch	4%	2.0	.0	
CAPR3	California harebell	4%	1.0	.0	
CASC2	rough harebell	33%	2.1	1.5	
CLUN	queen's cup	76%	3.6	2.8	
COMA3	spotted coral-root	19%	1.0	.0	
DIFO	Pacific bleedingheart	38%	1.0	.0	
DIHOO	Oregon fairybell	28%	1.5	.8	
ERSU2	three-veined fleabane	4%	1.0	.0	
FRVEB	woods strawberry	4%	1.0	.0	
FRUM	Umpqua frasera	4%	1.0	.0	
GAAP	catchweed bedstraw	4%	1.0	.0	
GAOR	Oregon bedstraw	14%	7.7	10.7	
GATR	fragrant bedstraw	4%	1.0	.0	
GADI	spreading groundsmoke	4%	1.0	.0	
GOOB	rattlesnake-plantain	28%	1.0	.0	
HAL	white-flowered hawkweed	28%	1.2	.4	
HYTE	Pacific waterleaf	4%	1.0	.0	
HYMO	fringed pinesap	4%	1.0	.0	
LIAP	celery-lyd licorice-rt	9%	1.0	.0	
LIBOL	western twinflower	14%	6.7	7.4	
LICA3	northwest listera	47%	1.3	.7	
LUAL	sickle-keeled lupine	4%	3.0	.0	
LUCA2	tailcup lupine	4%	2.0	.0	
MIBR	Brewer's mitrewort	4%	2.0	.0	
MOSI	candyflower	28%	1.3	.5	
OSCH	mountain sweet-root	14%	1.0	.0	
OSPU	purple sweet-root	14%	1.0	.0	
PERA	leafy lousewort	42%	1.1	.3	
PHHA	whiteleaf phacelia	4%	1.0	.0	
PHAD	woodland phlox	4%	1.0	.0	
POPU	skunk-leaved polemonium	4%	1.0	.0	
POMU	western sword-fern	9%	1.0	.0	
PTAQ	bracken	4%	3.0	.0	
PTAN	woodland pinedrops	4%	1.0	.0	
PYPI	whitevein pyrola	14%	1.0	.0	
PYSE	one-sided pyrola	71%	1.4	.6	
SMRA	western false Solomon's-seal	9%	1.0	.0	
SMST	starry Solomon-plume	52%	2.3	2.6	
TITR	foamflower	19%	2.0	2.0	
TRLA2	western starflower	4%	1.0	.0	
TROV	white trillium	66%	1.1	.4	
VASI	mountain heliotrope	23%	1.0	.0	
VAHE	white inside-out-fir	38%	1.9	1.0	
VECA	Calif. false hellebore	19%	1.0	.0	
VEVI	American false hellebore	9%	1.0	.0	
VIGL	stream violet	33%	2.7	3.3	
VIOR2	round-leaved violet	28%	1.3	.5	

WISE	redwoods violet	19%	1.0	.0	good for stabilizing disturbed sites
XETE	common beargrass	42%	8.4	11.8	
	TOTAL HERB	100%	27.1	27.1	
BRPA	Pacific brome	14%	1.0	.0	stabilizes disturbed sites stabilizes disturbed sites
BRVU	Columbia brome	4%	1.0	.0	
CAREX	sedge spp.	19%	1.0	.0	
CAGE	elk sedge	9%	1.5	.7	
CARO	Ross sedge	4%	1.0	.0	
ELGL	blue wildrye	4%	2.0	.0	
FEOC	western fescue	14%	1.0	.0	
FERU	red fescue	4%	3.0	.0	
JUNCU	rush spp.	4%	1.0	.0	
LUPA	smallflowered woodrush	14%	1.0	.0	
MESU	Alaska oniongrass	4%	1.0	.0	
TRCA	tall trisetum	4%	1.0	.0	
	TOTAL GRASS	100%	1.4	2.0	

**PACIFIC SILVER FIR / VINE MAPLE / FOAMFLOWER**  
*Abies amabilis* / *Acer circinatum* / *Tiarella trifoliata*  
**ABAM/ACCI/TITR**

**EXTENT:** **ABAM/ACCI/TITR** occurs on the North Umpqua Ranger District and is scattered on the Cottage Grove and Tiller Ranger Districts. It occurs in the Umpqua and Willamette basins and the Western Cascade Geological Subprovince. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** Vine maple cover is the most distinguishing vegetative characteristic of **ABAM/ACCI/TITR**. Mountain hemlock is essentially absent from both the **ABAM-TSHE/CLUN** and **ABAM/ACCI/TITR**.

**ABIOTIC ENVIRONMENT:** Parent rock is mostly intrusive basalt and andesite with occasional occurrences of Western Cascade tuffs and gabbro. **ABAM/ACCI/TITR** occurs on flat, moderately steep slopes (30 percent average) of all aspects near the ridge top or upper third of the slope. It is rarely found on the lower third or drainages. Soils average 46 inches deep. Litter usually covers the soils surface. Exposed soil occurs on about 4 percent of the area. Decomposition and incorporation of organic matter is most likely limited by soil temperature.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4701.0	163.0
Aspect (deg)	339.0	93.4
Slope (%)	28.9	15.8
Total soil depth (in)	46.2	6.3
Rooting depth (in)	48.3	3.7
Total basal area (ft <sup>2</sup> /ac)	305.0	70.7

**CLIMATE:** Average annual temperature is estimated to be 42 degrees F. Maximum summer temperature is about 75 degrees F. Low soil and air temperatures are the most limiting factor affecting biomass production. Annual average precipitation averages 70 inches. Snow accumulation varies between three and six feet. Growing season precipitation averages about 10 inches. Moisture stress is not likely to limit biomass production till late in the growing season when soils are warming and soil moisture is depleted.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.8	.4
Maximum month temp(F)	75.7	.6
Mean annual ppt (in)	70.0	.0
Dry season ppt (in)	10.0	.0

**FOREST FLOOR:** The forest floor is typical of the high elevation Cascade associations. Litter accumulates for years before it is incorporated into the soil. Decomposition rates are slow, but production of needles, small branches, and coarse wood is low.

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.4	3.3
Moss (%)	2.0	1.5
Bareground (%)	.0	.0
Gravel (%)	1.6	2.8
Rock (%)	1.4	.9
Bedrock (%)	.1	.4

**VEGETATION:** Douglas-fir will remain a dominant component in the stand for over 500 years on the more productive sites, but it will gradually be replaced by Pacific silver fir, white fir, and on the warmer sites, western hemlock. There are a variety of tolerant and intolerant shrubs. As such, canopy cover is not related to total shrub cover. However, *Rubus* species will significantly increase in cover and vigor after harvest.

Early seral species include Douglas-fir, white fir, vine maple, ribes, and *Rubus* species. Mountain hemlock, Pacific silver fir, and white fir are the common late seral tree species. Both early and late seral tree species can maintain high rates of volume production. Pacific yew is found on sites that have a higher than average level of atmospheric moisture (fog, dew, and high humidity).

**SILVICULTURE:** As always, pioneers are expected to achieve higher survival rates after harvest than late seral or climax species. The more intense the disturbance the greater the need for the pioneers in achieving high rates of survival. However, advanced

regeneration could provide fully stocked stands in some cases. **ABAM/ACCI/TITR** is about average for the series with regard to timber volume production.

Pacific rhododendron and vine maple are known to interfere with reforestation activities both physically and competitively. Salal can be a problem on sites where cover exceeds 60 percent. Snowbrush may not be present, but can be more of a barrier to reforestation than Pacific rhododendron. If it is present on nearby cutbanks, harvest units, or fill-slopes, it's possible that seed is present in the soil. Harvest activities, particularly burning, will produce *Ceanothus* thickets.

Site preparation and harvest activities can have a significant effect on long-term site productivity particularly on pumice and ash soils. Care should be taken to avoid disturbing surface layers. Soils building processes seem to be slow in the cold pumice soils.

**WATERSHED MANAGEMENT:** At 4700 feet (average elevation), a significant proportion of precipitation falls as snow. Forty seven inch deep soils absorb moisture and store it well into spring. Very few sites are erodable pyroclastic soils. Most are basic intrusives. Percolation and infiltration rates are rated as moderate by the SRI. Revegetation of disturbed sites is slow. Natural grasses such as red fescue, western fescue, and brome may be used. Timing seeding to correspond with adequate soil moisture and rain is the most important operational consideration.

**FIRE MANAGEMENT:** No evidence of fire was found on any of the plots. Weather generally is cold,

wet, but somewhat subject to winds. Fire regimes are likely to be similar to Cascade regimes: infrequent and intense. Summer precipitation, usually over 5 inches, tends to keep fuel moisture high except during unusually dry summers such as 1987.

Douglas-fir produces more ground fuels than the other tree species. The more tolerant species create vertically arranged fuels, but tend to decrease light penetration. Thus fuels would be produced at moderate levels, but slow to dry and decompose. Underburning would be one strategy to manage stocking levels, ground fuels, vertical fuels, fire risk, wildlife habitat, and disease.

**RANGE & WILDLIFE MANAGEMENT:** Potential for range use is low. Natural levels of forage are low, sites tend to recover slowly from disturbance, and water sources are scarce. Structural diversity, increasing with succession, provides average habitat breadth. In stands with high cover of true firs, pockets of gap-phase regeneration often provide excellent thermal cover. Douglas-fir will remain in the stand for several hundred years, but snags will begin to develop after about 150 years. Large snags over 40 inches are not likely to be produced under normal stocking levels and rotations.

**RECREATION & VISUAL MANAGEMENT:** Visual resources are average for general forest and lack special character. Stands are brushy, steep and difficult to walk through. Thin-leaved huckleberries are common in some stands, but the berry crops are usually sparse unless the stand has been opened by fire or other disturbance.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	75%	17.5	14.4	late seral species
ABCO	white fir	37%	18.3	18.9	co-climax species
ABMAS	Shasta red fir	25%	13.5	9.2	pioneer after disturbance
PIMO	western white pine	25%	12.5	3.5	cold sites, frost tolerant
PSME	Douglas-fir	87%	45.0	15.3	early seral species
TSHE	western hemlock	25%	5.0	.0	warmer sites
	TOTAL OVERSTORY	100%	67.1	19.0	
ABAM	—CONIFERS—				
ABAM	Pacific silver fir	100%	49.4	23.7	
ABCO	white fir	50%	6.3	2.5	
PIMO	western white pine	25%	1.0	.0	plant in cooler areas
TABR	Pacific yew	37%	2.3	1.2	likes higher than average atmospheric moisture
TSHE	western hemlock	62%	14.0	8.9	
	—HARDWOODS—				
ACCI	vine maple	100%	39.9	30.8	early seral species interferes with reforestation
	TOTAL UNDERSTORY	100%	102.2	31.0	
BENE	dwarf Oregongrape	50%	14.0	24.0	moderate climate
CHME	little prince's-pine	37%	3.0	3.5	reddish stem
CHUM	common prince's-pine	50%	1.5	1.0	mid to late successional, dry, cool to warm
COST	red-osier dogwood	12%	1.0	.0	
GASH	salal	12%	2.0	.0	can be a problem where more than 60% cover
HODI	creambush ocean-spray	12%	2.0	.0	
OECE	Indian plum	12%	1.0	.0	
PAMY	Oregon boxwood	12%	1.0	.0	moist conditions, cool sites
RHMA	Pacific rhododendron	25%	17.5	17.7	interferes with reforestation
RILA	swamp gooseberry	37%	1.7	.6	early seral species
ROGY	baldhip rose	75%	1.5	.5	
RULA	dwarf bramble	87%	1.6	.8	
RUPA	thimbleberry	12%	5.0	.0	
RUSP	salmonberry	12%	1.0	.0	
RUUR	Pacific blackberry	25%	4.0	4.2	
SARA	red elderberry	12%	5.0	.0	
SOSI	Sitka mountain-ash	12%	1.0	.0	birds like the berries
SYMO	creeping snowberry	37%	1.3	.6	warm, dry slopes
VAME	thin-leaved huckleberry	62%	2.2	1.6	
VAPA	red huckleberry	25%	1.0	.0	
	TOTAL SHRUB	100%	21.5	22.9	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	100%	11.1	11.0	moist areas
ACRU	baneberry	37%	5.0	3.5	
ADBI	trail-plant, pathfinder	50%	5.0	6.7	
ANDE	threeleaf anemone	87%	2.6	2.1	
ANLY2	Lyall anemone	25%	1.0	.0	
ARMA3	bigleaf sandwort	12%	1.0	.0	
ARLA	mountain arnica	37%	1.0	.0	
ASCA3	western wild ginger	37%	4.0	5.2	
ASTR	maidenhair spleenwort	12%	1.0	.0	
CASC2	rough harebell	62%	1.2	.4	
CIAL	alpine circaea	12%	1.0	.0	on sites with frost and deep snowpack
CLUN	queen's cup	100%	2.0	1.1	
COMA3	spotted coral-root	12%	1.0	.0	
COCA	bunchberry	12%	2.0	.0	
DIFO	Pacific bleedingheart	50%	1.0	.0	
DIHOO	Oregon fairybell	75%	13.3	16.9	
FRVEB	woods strawberry	12%	1.0	.0	
GAAP	catchweed bedstraw	50%	1.0	.0	
GAOR	Oregon bedstraw	37%	4.0	5.2	
GOOB	rattlesnake-plantain	62%	1.0	.0	warm sites, also disturbed sites
HAL	white-flowered hawkweed	37%	1.0	.0	
HYMO	fringed pinesap	12%	1.0	.0	
LAPO	leafy peavine	12%	1.0	.0	
LIBOL	western twinflower	37%	4.7	3.5	
LICA3	northwest listera	37%	1.0	.0	
MOSI	candyflower	37%	2.0	0	
NEHE	small white nemophila	12%	1.0	.0	
OSCH	mountain sweet-root	37%	4.0	5.2	
PERA	leafy lousewort	37%	1.3	.6	generally on productive sites invades after heavy disturbance
PHAD	woodland phlox	25%	1.5	.7	
POMU	western sword-fern	12%	1.0	.0	
PTAQ	bracken	50%	1.5	1.0	
PYPI	whitevein pyrola	50%	1.0	.0	
PYSE	one-sided pyrola	50%	1.0	0	
SMRA	western false Solomon's-seal	25%	1.0	0	
SMST	starry Solomon-plume	87%	20.1	30.8	
SURA	buttercup-leaved suksdorfia	12%	1.0	0	
SYRE	snow-queen	25%	1.5	.7	warm, moist sites
TITR	foamflower	100%	5.8	5.5	
TRLA2	western starflower	12%	2.0	.0	
TROV	white trillium	62%	1.0	.0	
VAHE	white inside-out-flr	87%	3.3	3.3	
VECA	Calif. false hellebore	12%	1.0	0	
VIAM	American vetch	12%	1.0	0	
VIGL	stream violet	50%	1.8	1.0	
VIOR2	round-leaved violet	37%	4.0	2.6	
WISE	redwoods violet	12%	1.0	.0	cold
XETE	common beargrass	12%	7.0	.0	
	TOTAL HERB	100%	74.7	49.4	
BROMU	brome spp.	12%	3.0	.0	
CARO	Ross sedge	12%	1.0	.0	
LUCA2	tailcup lupine	12%	3.0	.0	
LUPA	smallflowered woodrush	12%	1.0	.0	
MESU	Alaska oniongrass	12%	2.0	.0	
	TOTAL GRASS	100%	1.3	2.1	

**PACIFIC SILVER FIR - WESTERN HEMLOCK / QUEEN'S CUP**  
*Abies amabilis* - *Tusga heterophylla* / *Clintonia uniflora*  
**ABAM-TSHE/CLUN**

**EXTENT:** This association occurs mostly on the Diamond Lake Ranger District and occasionally on the Steamboat Ranger District at elevations above 4000 feet. It has been sampled only in the High Cascade Subprovince in the Umpqua Basin. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** The most distinguishing vegetative characteristic of the ABAM-TSHE/CLUN is the presence of western hemlock. It seems to have the most moderate environment in the Series. Yet, on the average, it has been found to support fewer shrubs and herbs than the other associations. It is similar in composition to the ABAM-TSHE/RHMA found on the Mt. Hood National forest (Hemstrom et al. 1987) but lacks the high cover of Pacific rhododendron and salal.

**ABIOTIC ENVIRONMENT:** Parent rock is mostly intrusive (dacite to basalt in composition) and occasionally pyroclastic of pumice and ash size. Soils average 49 inches deep. Presumably the basalts are the most fertile soils, but differences in age, development, and vegetative interaction confound such a simple interpretation. The Forest soil scientists are beginning to amass a substantial data base on local fertility. Check with them or have a sample analyzed to answer questions regarding fertility. The surface is covered with litter, moss, or vegetation. Exposed soil is rare. Decomposition and incorporation of organic matter is most likely limited by soil temperature. The ABAM-TSHE/CLUN Association occurs on flat or convex slopes from 3 to 70 percent, on the lower third or middle third position. It is not found on ridgetops and not often found on upper third positions. It is sometimes found on benches, but not usually in cold concavities.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4736.0	306.0
Aspect (deg)	22.4	28.2
Slope (%)	32.1	24.6
Total soil depth (in)	49.1	2.5
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	296.7	124.8

**CLIMATE:** Average annual temperature is estimated to be 43 degrees F, approximately a degree warmer than the other two associations of the series. This temperature difference may help to explain the presence of western hemlock in ABAM-TSHE/CLUN. Maximum summer temperature is about 75 degrees F. Moisture stress is not likely to limit biomass production till late in the growing season when soils are warming and soil moisture is depleted. Still with summer precipitation, some recovery would be expected. Diurnal moisture stress recovery is likely to be common also. Thus, some early morning photosynthesis would be expected well into the growing season. A combination of low soil and air temperatures probably limit biomass production more than any other factors.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.5	1.0
Maximum month temp(F)	75.5	1.4
Mean annual ppt (in)	63.6	5.6
Dry season ppt (in)	9.3	1.0

**FOREST FLOOR:** Although litter is not produced at a high rate, accumulations of four to six inches may be found. Because of cool air and soil temperatures decomposition rates are low. Surface rock or bed rock is rare.

FOREST FLOOR	MEAN	S.D.
Litter (%)	97.7	3.5
Moss (%)	24.6	29.5
Bareground (%)	.4	.8
Gravel (%)	.0	.0
Rock (%)	2.6	3.2
Bedrock (%)	.1	.4

**VEGETATION:** Douglas-fir is successional to Pacific silver fir and western hemlock, but will remain a dominant component in the stand for over 500 years on the more productive sites. There are a variety of tolerant and intolerant shrubs. As such, canopy cover is not related to total shrub cover. However, thin-leaved huckleberry cover is related to canopy cover

and will decrease in vigor as the canopy becomes more dense, and increase in vigor and production (berries) as the stand decays.

Mountain hemlock, western white pine, Pacific silver fir, Shasta red fir, white fir, Douglas-fir, and western hemlock commonly occur in the overstory. They are listed in order of decreasing indication of cold. Pacific yew is found on sites that have a higher than average level of atmospheric moisture (fog, dew, and high humidity). The common Cascade herbs, vanillaleaf, foamflower, white inside-out-flower, and queen's cup are present, but indicate little more than your presence in the woods.

**SILVICULTURE:** Within the Association, species should be matched to environment. Mountain hemlock, for example, should only be planted on the coldest sites. The risk of Douglas-fir mortality increases as the cover of the cold indicators increases. Moreover, potential production decreases. Douglas-fir, Shasta red fir, and western hemlock are the most appropriate generalists for utilizing site resources. Microsite planting of the more specialized species would encourage diversity and increase overall biomass production. Not much is known about the potential for relying on natural seeding. Casual observation may give some indication of the possibility for success.

Pacific rhododendron and thin-leaved huckleberry are the two most apparent shrubs. Pacific rhododendron is known to interfere with reforestation activities both physically and competitively. Competitive potential should be evaluated during sale planning. Thin-leaved huckleberry seems to be less of a competitor, but more information is needed. Snowbrush may not be present, but can be more of a barrier to reforestation than Pacific rhododendron. If it is present on nearby cutbanks or fillslopes, it is possible that seed is present in the soil. Harvest activities, particularly burning, will produce thick stands of Ceanothus.

Site preparation and harvest activities can have a significant effect on long-term site productivity particularly on pumice and ash soils. Care should be taken to avoid disturbing surface layers. Soils building processes are slow in the cold, pumice soils.

**WATERSHED MANAGEMENT:** A significant proportion of precipitation falls as snow and is stored on site well into spring. The relatively deep soils (49

inches) with medium textures can hold over 20 inches of water. About 25 percent will immediately run off. Yearly average precipitation is 65 inches, with about 9 inches falling during the growing season. Percolation and infiltration rates are moderate to rapid where cementation of the subsurface is absent. The few sites with pumice/ash soils differ. Runoff and sediment production generally is higher, holding capacity is lower, percolation usually higher, and the potential for sediment production is much higher on the pumice/ash soils. Revegetation of disturbed sites is slow. Natural grasses such as red fescue, western fescue, and brome may be used. Timing seeding to correspond with adequate soil moisture and rain is the most important operational consideration.

**FIRE MANAGEMENT:** Evidence of fire was found on two of the seven plots. In both cases indications suggested low intensity understory burns. Intense burns occur approximately every 200 years. The **ABAM-TSHE/CLUN** occurs on cool, north, protected slopes where high winds infrequently occur, diurnal humidity recovery is high, and summer precipitation is usually over 5 inches.

Douglas-fir produces more ground fuels than the other tree species. The more tolerant species create vertically arranged fuels, but tend to decrease light penetration. Thus fuels would be produced at moderate levels, but be slow to dry and decompose. Underburning would be one strategy to manage stocking levels, ground fuels, vertical fuels, fire risk, wildlife habitat, shrub competition and disease.

**RANGE & WILDLIFE MANAGEMENT:** **ABAM-TSHE/CLUN** has low (lower than whale poop) (Hopkins, pers comm) potential for range use. Natural levels of forage are low, sites tend to recover slowly from disturbance, and water sources are scarce. Structural diversity, increasing with succession, provides average habitat breadth. In stands with high cover of true firs, pockets of gap-phase regeneration often provide excellent thermal cover. Heavy huckleberry crops do not consistently occur. They are shade tolerant, but berry production is negatively related to canopy density. Douglas-fir will remain in the stand for several hundred years, but snags will begin to develop after about 150 years.

**RECREATION & VISUAL MANAGEMENT:** Most sites have average visual resources and lack spe-

cial character. The berry crops, however, may attract gatherers in the fall during productive years.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	100%	15.1	14.6	climax species
ABCO	white fir	14%	2.0	.0	co-climax
ABMAS	Shasta red fir	71%	11.2	7.9	generalist for utilizing site resources
PIMO	western white pine	28%	3.5	2.1	cold sites, frost tolerant
PSME	Douglas-fir	100%	25.4	24.4	early successional, generalist
TSHE	western hemlock	100%	26.4	23.8	warmer site, co-climax
TSME	mountain hemlock	14%	5.0	.0	cold sites
	TOTAL OVERSTORY	100%	77.0	13.0	
	—CONIFERS—				
ABAM	Pacific silver fir	100%	38.6	16.3	cold, stable, even, protected conditions
ABCO	white fir	42%	13.3	5.8	warm, stable, even, protected conditions
TABR	Pacific yew	14%	10.0	.0	higher than average atmospheric moisture
TSHE	western hemlock	100%	30.0	17.3	
TSME	mountain hemlock	14%	2.0	.0	only planted on coldest sites
	—HARDWOODS—				
ACGL	Douglas maple	14%	3.0	.0	indicates moist, rocky sites
CACH	golden chinquapin	14%	3.0	.0	indicates shallow, rocky soils
	TOTAL UNDERSTORY	100%	76.9	33.3	
BENE	dwarf Oregongrape	42%	3.7	6	state shrub
CHME	little prince's-pine	28%	1.0	.0	indicates low light levels
CHUM	common prince's-pine	71%	1.8	1.3	dry, cool to warm
GAOV	slender salal	14%	1.0	.0	mid to late successional
PAMY	Oregon boxwood	28%	1.0	.0	generally well-drained soils
RHMA	Pacific rhododendron	14%	4.0	.0	interferes with reforestation
RILA	swamp gooseberry	42%	2.0	1.0	
ROGY	baldhip rose	42%	1.0	.0	moderate to easy regeneration
RULA	dwarf bramble	14%	2.0	.0	
RUUR	Pacific blackberry	57%	1.3	.5	
SYMO	creeping snowberry	14%	1.0	.0	
VAME	thin-leaved huckleberry	85%	2.7	1.6	berry production negatively related to canopy density
	TOTAL SHRUB	100%	8.0	3.8	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	85%	2.2	1.5	on wetter sites
ADBI	trail-plant, pathfinder	42%	1.3	.6	
ANDE	threelaf anemone	14%	2.0	.0	
ARMA3	bigleaf sandwort	14%	1.0	.0	late successional
ASCA3	western wild ginger	14%	3.0	.0	
CASC2	rough harebell	42%	1.0	.0	
CLUN	queen's cup	100%	1.4	.8	
COME	Pacific coral-root	28%	1.0	.0	
COST2	hooded coral-root	14%	1.0	.0	
COCA	bunchberry	14%	1.0	.0	generally warm sites
DIFO	Pacific bleedingheart	14%	1.0	.0	
DIHOO	Oregon fairybell	57%	1.0	.0	
FRVEB	woods strawberry	14%	1.0	.0	
GAAP	catchweed bedstraw	14%	1.0	.0	
GAOR	Oregon bedstraw	14%	1.0	.0	
GOOB	rattlesnake-plantain	42%	1.0	.0	
HAL	white-flowered hawkweed	14%	1.0	.0	
LIBOL	western twinflower	42%	3.0	1.0	
LICA3	northwest listera	14%	1.0	.0	
MOSI	candyflower	28%	1.5	.7	
PERA	leafy lousewort	14%	1.0	.0	
POMU	western sword-fern	14%	1.0	.0	productive sites
PTAQ	bracken	28%	1.0	.0	
PYSE	one-sided pyrola	85%	1.5	.5	
SEBO	Bolander's groundsel	14%	1.0	.0	all flowers hang to one side of the stem
SMST	starry Solomon-plume	71%	2.6	2.5	
TITR	foamflower	85%	2.0	.6	
TROV	white trillium	42%	1.0	.0	
VAHE	white inside-out-flr	100%	1.4	.5	
VIGL	stream violet	28%	1.0	.0	
VIOR2	round-leaved violet	57%	1.0	.0	
	TOTAL HERB	100%	15.3	9.5	
	TOTAL GRASS	100%	.1	.4	

# SHASTA RED FIR SERIES

## *Abies magnifica shastensis*

### ABMAS

Shasta red fir (*Abies magnifica* Murr. var. *Shastensis* Lemm.) is a variety of California red fir (*Abies magnifica* Murr.) that is prevalent in Southwest Oregon. It is interfertile with noble fir (*Abies procera* Rehd.) and California red fir. Morphological and genetic characteristics of the trio are similar, thus identification or differentiation in the southwest Oregon area is less than tentative. Populations north of the McKenzie river are recognizable as noble fir. In northern California red fir characteristics dominate.

## THE SERIES

**EXTENT:** The Shasta red fir series occurs in a narrow band between 4500 and 6000 feet in elevation from the Ashland to the Diamond Lake Ranger Districts. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** It often is associated with mountain hemlock at the upper limits of its elevational range and white fir, Douglas-fir, incense-cedar, sugar pine, and rarely western hemlock at the lower limits. Shasta red fir dominates the regeneration layer and is most efficient where it is too cold for white fir and too warm for mountain hemlock. Most sites are temperature, not moisture, limited. Soils usually are deep and fertile.

**ABIOTIC ENVIRONMENT:** Parent rock usually is basalt/andesite, occasionally pumice/ash, or rarely tuffs. Most of the pumice/ash is from the Mazama eruption. Consequently, soils are young, poorly developed, and infertile. Basaltic soils usually are much older, well developed, and fertile. These soils also tend to be warmer. The higher rock content affects the heat dynamics. The surface rocks store and transfer heat well, releasing it to colder surroundings at night, and collecting heat during the day. Rocks may also help to discourage gopher

activity. Casual observations suggest there are fewer gophers on rocky sites.

Sites are cold (Figure 9). Soil temperature limits biomass production and decomposition and air temperature extremes often are fatal to Douglas-fir. Temperatures above 80 degrees F. are rare, but moisture stress on pumice soils occurs early in the growing season. About 70 percent of the annual precipitation falls as snow. Most summer precipitation (about 20 percent of total) is associated with thundershowers. The highest cover of Shasta red fir is found on northern aspects, partly because of lower transpirational demand. Shasta red fir has a low tolerance to drought.

Shasta red fir cover (and leaf area) increases with elevation between 3600 and 6600 feet in elevation. The average elevation for the species, about 5000 feet, is only 50 feet lower than the average for the Series. It is the climax dominant between approximately 4600 and 6200 feet, or about half the range of the species. Mountain hemlock at the higher elevations and white fir at the lower elevations seem to be more efficient in gathering site resources.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	4600	6060	1460	5444.0	520.0	
Aspect (deg)	-	-	-	314.2	44.2	
Slope (%)	0	55	55	19.1	20.2	
Total soil depth (in)	3.9	50.0	46.1	29.7	16.6	
Rooting depth (in)	11.8	50.0	38.2	35.0	15.8	
Total basal area (ft <sup>2</sup> /ac)	60	480	420	271.4	158.3	

## CLIMATE:

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	39.4	43.2	3.8	40.9	1.3	
Maximum month temp (F)	70.3	76.3	6.0	72.8	2.1	
Mean annual ppt (in)	35	75	40	59.3	15.4	
Dry season ppt (in)	6	10	4	8.1	1.5	

**FOREST FLOOR:** Litter covers the forest floor. Bareground, surface rock, rock outcrops, gravel, and moss is rare. Soil surfaces are cool throughout the year under the forest canopy. Decomposition

and incorporation of litter and duff is slow. Because many species are shade tolerant, litter production is low and several years of duff, litter, branches, and boles may accumulate.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	80	98	18	93.4	6.6	
Moss (%)	0	7	7	2.9	2.7	
Bareground (%)	0	10	10	2.4	3.5	
Gravel (%)	0	5	5	1.1	1.9	
Rock (%)	0	10	10	2.9	3.6	
Bedrock (%)	0	0	0	.0	.0	

**VEGETATION:** Lodgepole pine is one of the most aggressive invaders after severe disturbance, particularly fire. Phacelia and lupine often are its pioneer associates on flat, cold sites. On warmer sites Douglas-fir, incense-cedar, and western white pine pioneer with trailing blackberry and brome. Sedge can proliferate after soil surface disturbance. Long-stolon sedge often will form a thick sod that is difficult to plant through. It also aggressively competes for site resources. Thin-leaved huckleberry dies back immediately after harvest, but will slowly regain its dominance and increase berry production.

The two associations in the series are **ABMAS/VAME**, and the rare **ABMAS-CHNO**. The latter occurs on high elevation rock outcrops and in cirques. **ABMAS/VAME** is the most common. It occurs on the colder sites and often associates with vegetation of the Mountain Hemlock Series.

**SILVICULTURE:** Southern aspects and flat slopes are the most difficult to reforest. Flats are associated with frost; and southern aspects, particularly on coarse textured soils, dry early in the growing season. Germination rates are low, often less than five percent, but seed rain is heavy. Overstocking (4000+ seedlings per acre) in small clear-cuts or partially harvested areas is common.

Production of Shasta red fir peaks between 4600 and 6000 feet in elevation. Production seems to decrease with increasing elevation on north as-

pects, but increases with increasing elevation on south aspects. Low soil temperatures may be the cause.

**WATERSHED MANAGEMENT:** Soils usually are deep and porous, well protected with vegetation and litter, and sites recover quickly after disturbance. Summer thundershowers provide up to 22 percent of the total annual precipitation (ROS data) which averages about 60 inches. Lodgepole pine is one of the most easily regenerated trees if rapid reforestation is required. There are a variety of deep rooted lupines that provide soil stability.

**FIRE MANAGEMENT:** Fires creep into the upper reaches of the Shasta red fir Series on extremely dry years. Most often, the result is patchy, low severity, underburns. Stand replacement fires, although rare, do occur. Fuel production is related to the complement of conifers dominating the stand. Light intolerant species such as Douglas-fir, produce ground fuels as they naturally prune. Dead needles and branches accumulate slowly at first, but 20 years after stand closure, suppressed trees begin to significantly increase heavy fuels as they die and fall. Early seral stages are less likely to produce thick continuous stands with high surface area, particularly when Shasta red fir is dominant. Stands dominated by Shasta red fir later in succession, produce less ground fuels, but retain lower branches which can carry fire into the crowns.



*RANGE AND WILDLIFE MANAGEMENT:* Although the amount of forage may not be high in some stands, there is a variety, and it is available late in the summer. Shrubs such as western serviceberry, thinleaved huckleberry, and ceanothus (on disturbed sites) are used by browsers. The variation in structural and compositional diversity is similar to other series.

*RECREATION AND VISUAL MANAGEMENT:* Stands are typical of the Cascades, but they occur on upper slope positions where opportunities for vistas are present. Huckleberries are common, but crops usually are not abundant. Slopes often are under 20 percent and both summer and winter recreation opportunities exist.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABCO	white fir	42%	5	10	5	7.7	2.5	
ABMAS	Shasta red fir	100%	15	75	60	41.4	21.4	
PICO	lodgepole pine	28%	7	45	38	26.0	26.9	
PIMO	western white pine	28%	2	10	8	6.0	5.7	
PSME	Douglas-fir	28%	7	10	3	8.5	2.1	
TSME	mountain hemlock	57%	5	15	10	8.0	4.8	
	TOTAL OVERSTORY	100%	20	85	65	60.9	20.0	
	—CONIFERS—							
ABCO	white fir	57%	5	10	5	8.8	2.5	
ABMAS	Shasta red fir	100%	12	55	43	31.7	14.5	
CHNO	Alaska-cedar	14%	15	15	0	15.0	.0	
PICO	lodgepole pine	28%	5	15	10	10.0	7.1	
PIMO	western white pine	42%	1	3	2	1.7	1.2	
TSME	mountain hemlock	57%	4	30	26	13.5	11.4	
	—HARDWOODS—							
CACH	golden chinquapin	28%	2	10	8	6.0	5.7	
	TOTAL UNDERSTORY	100%	30	83	53	51.9	20.2	
AMAL	western serviceberry	14%	3	3	0	3.0	.0	
ARNE	pinemat manzanita	42%	3	30	27	12.7	15.0	
CHUM	common prince's-pine	85%	1	30	29	12.2	12.4	
GAOV	slender salal	14%	10	10	0	10.0	.0	
PAMY	Oregon boxwood	57%	2	5	3	3.3	1.3	
RIER	Crater Lake currant	14%	8	8	0	8.0	0	
RIVI	sticky currant	28%	2	5	3	3.5	2.1	
ROGY	baldhip rose	42%	1	2	1	1.7	.6	
RULA	dwarf bramble	42%	1	15	14	6.0	7.8	
SYMO	creeping snowberry	14%	1	1	0	1.0	.0	
VAME	thin-leaved huckleberry	85%	1	85	84	25.7	31.0	
	TOTAL SHRUB	100%	12	96	84	47.1	29.5	
ANDE	threeleaf anemone	57%	1	1	0	1.0	.0	
ANLY2	Lyal anemone	14%	2	2	0	2.0	.0	
ARMA3	bigleaf sandwort	42%	1	3	2	2.0	1.0	
ASCA3	western wild ginger	14%	1	1	0	1.0	.0	
CATO	Tolmie's mariposa	14%	1	1	0	1.0	.0	
CLUN	queen's cup	28%	1	1	0	1.0	.0	
COMA3	spotted coral-root	14%	1	1	0	1.0	.0	
COST2	hooded coral-root	14%	1	1	0	1.0	.0	
DIFO	Pacific bleedingheart	14%	3	3	0	3.0	.0	
DIHOO	Oregon fairybell	14%	1	1	0	1.0	.0	
EPAN	fireweed	14%	1	1	0	1.0	.0	
FRVEB	woods strawberry	28%	1	3	2	2.0	1.4	
HIAL	white-flowered hawkweed	28%	1	1	0	1.0	.0	
LIBOL	western twinflower	28%	2	2	0	2.0	.0	
LICA3	northwest listera	28%	1	1	0	1.0	.0	
MECI	ciliate bluebells	14%	1	1	0	1.0	.0	
OSCH	mountain sweet-root	28%	1	1	0	1.0	.0	
PHHE	varleaf phacelia	14%	1	1	0	1.0	.0	
PHDI	spreading phlox	14%	1	1	0	1.0	.0	
POMU	western sword-fern	14%	1	1	0	1.0	.0	
POTEN		14%	1	1	0	1.0	0	
PTAN	woodland pinedrops	14%	1	1	0	1.0	.0	
PYPI	whitevein pyrola	28%	1	1	0	1.0	0	
PYSE	one-sided pyrola	57%	1	3	2	1.8	1.0	
SEOR2	Oregon stonecrop	14%	2	2	0	2.0	.0	
SMST	starry Solomon-plume	42%	1	5	4	2.3	2.3	
	TOTAL HERB	100%	2	17	15	9.0	5.5	
BROMU	brome spp.	28%	1	1	0	1.0	.0	
CAREX	sedge spp.	28%	1	3	2	2.0	1.4	
MESU	Alaska oniongrass	14%	1	1	0	1.0	.0	
	TOTAL GRASS	100%	0	4	4	1.7	1.7	

## SHASTA RED FIR KEY

- 1a Alaska-cedar [CHNO] present.
- 1b Alaska-cedar [CHNO] absent.

ABAMS-CHNO  
ABMAS/VAME

## SHASTA RED FIR ASSOCIATIONS

ABMAS-CHNO pg. 90	Shasta red fir - Alaska-cedar <i>Abies magnifica shastensis</i> - <i>Chamaecyparis nootkatensis</i>
ABMAS/VAME pg. 93	Shasta red fir / Thin-leaved huckleberry <i>Abies magnifica shastensis</i> / <i>Vaccinium membranaceum</i>

**SHASTA RED FIR - ALASKA-CEDAR**  
*Abies magnifica shastensis* - *Chamaecyparis nootkatensis*  
**ABMAS-CHNO**

**EXTENT:** This Association occurs on the Rogue River and Umpqua National Forests. It is most common on the Prospect Ranger District and on scattered high elevation ridges on the Diamond Lake Ranger District. It is an unusual habitat which often supports rare plants. N = 1 plot.

**IDENTIFYING CHARACTERISTICS:** **ABMAS-CHNO** occurs on rocky ridges and north facing coves where Alaska-cedar is found in clumps or occasionally alone. Shasta red fir and mountain hemlock are common associates. Shrub and herb cover is low and tree cover is sparse but can be as high as 60 percent.

**ABIOTIC ENVIRONMENT:** Shallow, cold soils, low growing season temperatures, and surface rock characterize most sites.

ABIOTIC	MEAN	S.D.
Elevation (ft)	6060.0	0.0
Aspect (deg)	257.0	.0
Slope (%)	55.0	.0
Total soil depth (in)	3.9	.0
Rooting depth (in)	11.8	.0
Total basal area (ft <sup>2</sup> /ac)	60.0	.0

**CLIMATE:** Average annual temperature is about 39 degrees F. Average annual precipitation is about 75 inches. High winds are common and transpirational demands are high. Vegetation is often wind trained.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	39.4	.0
Maximum month temp(F)	70.3	.0
Mean annual ppt (in)	75.0	.0
Dry season ppt (in)	10.0	.0

**FOREST FLOOR:** Unlike most high elevation Cascade sites, surface rock is common and soils are extremely shallow. Litter cover, needles and small branches, is typically high. Soil usually are skeletal.

FOREST FLOOR	MEAN	S.D.
Litter (%)	98.0	.0
Moss (%)	1.0	.0
Bareground (%)	2.0	.0
Gravel (%)	5.0	.0
Rock (%)	10.0	.0
Bedrock (%)	.0	.0

**VEGETATION:** Shasta red fir is dominant and mountain hemlock occurs occasionally. Shrub and herb cover is less than remarkable, but the potential for uncommon or sensitive species is high. There are several mustards, lilies, and figwarts that require this or similar habitat.

**SILVICULTURE:** Most sites are unsuitable for timber production.

**WATERSHED MANAGEMENT:** Of the 75 inches of precipitation, about 8 inches falls between May and September resulting from thundershowers. Over ten feet of snow may fall during the average winter, but less than half that amount accumulates on these ridgetop sites. Infiltration and percolation rates are high and litter cover is extensive but thin. Revegetation after disturbance is slow. Soil and air temperatures, soil depth and fertility, and moisture stress limit both reproduction and growth.

**FIRE MANAGEMENT:** Fuel production and accumulation is slow and distribution is broken. Weather is relatively cool and moist, but sites are windy and have a high potential for lightning. Evidence of fire was not found on the sampled site or observed on other similar sites. The greenleaf manzanita and the varileaf phacelia, indicative of disturbance, was stimulated by trail maintenance and clearing for Hershberger lookout tower.

**RANGE & WILDLIFE MANAGEMENT:** Stand structure generally is open but clumpy. Forage, browse, and cover is lacking. Some rock talus habitat is present.

**RECREATION & VISUAL MANAGEMENT:** The open habit provides vista opportunities and a diversity of

spring wildflowers. Shelter from sun and wind and flat campsites are rare. The sites seem to be inter-

esting to travel through, but do not provide much potential for camping.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABMAS TSME	Shasta red fir mountain hemlock TOTAL OVERSTORY	100% 100% 100%	55.0 5.0 60.0	.0 .0 .0	climax species will be replaced by climax species
ABMAS CHNO	—CONIFERS— Shasta red fir Alaska-cedar TOTAL UNDERSTORY	100% 100% 100%	25.0 15.0 40.0	.0 .0 .0	co-climax species
ARNE PAMY RVI ROGY	pinemat manzanita Oregon boxwood sticky currant baldhip rose TOTAL SHRUB	100% 100% 100% 100% 100%	3.0 2.0 5.0 2.0 12.0	.0 .0 .0 .0 .0	pioneer, rocky surface soils
ANDE ARMA3 CATO DIFO EPAN MECI PHHE PHDI POMU SEOR2 SMST	threeleaf anemone bigleaf sandwort Tolmie's mariposa Pacific bleedingheart fireweed ciliate bluebells varleaf phacelia spreading phlox western sword-fern Oregon stonecrop starry Solomon-plume TOTAL HERB	100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100%	1.0 2.0 1.0 3.0 1.0 1.0 1.0 1.0 1.0 2.0 1.0 17.0	.0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	wet, cool sites  disturbance species stimulated by disturbance
	TOTAL GRASS	100%	1.0	.0	

**SHASTA RED FIR / THIN-LEAVED HUCKLEBERRY**  
*Abies magnifica shastensis* / *Vaccinium membranaceum*  
**ABMAS/VAME**

**EXTENT:** Found mostly on the Ashland, Butte Falls, and Prospect Ranger Districts, it occurs less often on the Diamond Lake Ranger District of the Umpqua National Forest. N = 6 plots.

**IDENTIFYING CHARACTERISTICS:** Mountain hemlock and thin-leaved huckleberry are the most prominent species associated with Shasta red fir. Thin-leaved huckleberry cover varies widely but has high fidelity (is almost always present). Compared with associations in the White Fir Series, **ABMAS/VAME** lacks herb cover.

**ABIOTIC ENVIRONMENT:** Soil depth (34 inches) is seven inches shallower than the Cascade average. Sites are equally likely to be on ash or basalt. The basalt soils are productive and usually well developed, but ashy soils are relatively infertile, young, and fragile. Soil and air temperatures are the most important factors limiting growth and survival.

ABIOTIC	MEAN	S.D.
Elevation (ft)	5342.0	486.0
Aspect (deg)	324.5	39.6
Slope (%)	13.2	13.7
Total soil depth (in)	34.0	13.3
Rooting depth (in)	38.9	13.2
Total basal area (ft <sup>2</sup> /ac)	306.7	140.1

**CLIMATE:** Average annual temperature is about 41 degrees F. The ashy soils, with their lack of heat storage capacity and heat conductance, seem to magnify the temperature limitations. (Refer to the discussion on ash soils in the High Cascade Subprovince description.) Although harvest increases the radiation load warming the soil, evaporation rates will be accelerated. The end result may be substituting soil moisture problems for soil temperature problems, particularly on the ash and/or shallower soils. Where ashy, shallow soils occur on flats or slopes less than 15 percent, frost may damage even juvenile stands.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	41.2	1.3
Maximum month temp(F)	73.2	2.0
Mean annual ppt (in)	56.7	15.1
Dry season ppt (in)	7.8	1.3

**FOREST FLOOR:** Fine litter, needles and small branches, covers the cool, forest floor. Moss cover, positively related to temperature, is low and surface and exposed bedrock is rare. Decomposition of litter is slow, but the rate of production is also slow. Several years of accumulated litter is the rule.

FOREST FLOOR	MEAN	S.D.
Litter (%)	92.7	6.9
Moss (%)	3.2	2.9
Bareground (%)	2.5	3.8
Gravel (%)	.5	8
Rock (%)	1.7	2.0
Bedrock (%)	.0	.0

**VEGETATION:** Although Shasta red fir dominates, many stands have high cover of lodgepole pine which was post-fire generated. It will persist well into the stand cycle, but remain in a subordinate position. Douglas-fir and white fir significantly influence site characteristics. White fir provides understory vertical structure and Douglas-fir, with its tendency to naturally prune, cycles needles and drops branches readily. Douglas-fir is an early successional species and occupies disturbed sites. Mountain hemlock's presence indicates cold. On most sites it shares climax status with Shasta red fir. Western wild ginger occurs on the wetter sites and common beargrass occurs on the drier sites.

**SILVICULTURE:** Shasta red fir, white fir and Douglas-fir are productive, incense-cedar and lodgepole pine will survive dry and cold extremes respectively, and Englemann spruce is well adapted to cold, moist drainages. *Ribes* species may proliferate after harvest, but they do not usually require management. However, snowbrush which is at its upper elevation limits has the potential to provide

competition. Lodgepole pine is the most likely species to pioneer on moderate to severely disturbed sites. When it is associated with stoloniferous sedges, reforestation can be a problem. The sedge is a physical barrier and competes for nutrients and water as well. Prompt reforestation and reducing the severity of disturbance are the most obvious solutions.

**WATERSHED MANAGEMENT:** Annual precipitation averages 60 inches with 6-10 inches falling between May and September. Soils are well protected by litter. They absorb and transfer water without restriction. Sites are generally productive and compositionally diverse and recover quickly from disturbance. Catchweed bedstraw, starflower, leafy peavine, and common beargrass would be appropriate naturals to use in recovery projects.

**FIRE MANAGEMENT:** The fire free period is estimated to be between 70 and 130 years. When fires do occur, most are not severe, extensive stand replacement fires. They tend to be small, low intensity fires with local affects. Fires the magnitude of the

Cat Hill burn which may encroach on these sites occur less often. Fuel production is high and decomposition is relatively low, thus the rate of accumulation is high. However, drying is slow in natural stands. Stands tend to be multistoried with white fir and Shasta red fir creating a fuel ladder. Early seral stages tend to be thick lodgepole which seem to set themselves up for reburning. Firewood sales, thinning, and pole sales may help to reduce risk by reducing loads and creating breaks.

**RANGE & WILDLIFE MANAGEMENT:** The multilayered and clumpy stand structure and coarse woody debris provide a variety of wildlife habitat. There are a number of palatable herbs. Water courses commonly dissect this association and riparian habitat is usually near.

**RECREATION & VISUAL MANAGEMENT:** Stands are typical Cascade upperslope forests with no special characteristics. They provide solitude and cool atmosphere for hiking, birding and hunting.



# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	7.7	2.5	productive, creates fuel ladder
ABMAS	Shasta red fir	100%	39.2	22.5	productive, creates fuel ladder
PICO	lodgepole pine	33%	26.0	26.9	survives cold extremes, subordinate position
PIMO	western white pine	33%	6.0	5.7	
PSME	Douglas-fir	33%	8.5	2.1	naturally prunes, cycles needles and drops branches
TSME	mountain hemlock	50%	9.0	5.3	indicates cold, co-climax
	TOTAL OVERSTORY	100%	61.0	21.9	
ABCO	---CONIFERS---				
ABCO	white fir	66%	8.8	2.5	provides understory vertical structure
ABMAS	Shasta red fir	100%	32.8	15.5	
PICO	lodgepole pine	33%	10.0	7.1	post-fire generated
PIMO	western white pine	50%	1.7	1.2	frost tolerant
TSME	mountain hemlock	66%	13.5	11.4	
	---HARDWOODS---				
CACH	golden chinquapin	33%	6.0	5.7	indicates shallow, rocky soils
	TOTAL UNDERSTORY	100%	53.8	21.4	
AMAL	western serviceberry	16%	3.0	.0	
ARNE	pinemat manzanita	33%	17.5	17.7	rocky sites, all types of soils
CHUM	common prince's-pine	100%	12.2	12.4	
GAOV	slender salal	16%	10.0	.0	cool, moist
PAMY	Oregon boxwood	50%	3.7	1.2	
RIER	Crater Lake currant	16%	8.0	.0	
RIVI	sticky currant	16%	2.0	.0	
ROGY	baldhip rose	33%	1.5	.7	
RULA	dwarf bramble	50%	6.0	7.8	
SYMO	creeping snowberry	16%	1.0	.0	warm, dry slopes
VAME	thin-leaved huckleberry	100%	25.7	31.0	cool, moist sites
	TOTAL SHRUB	100%	53.0	27.4	
ANDE	threeleaf anemone	50%	1.0	0	
ANLY2	Lyll anemone	16%	2.0	.0	
ARMA3	bigleaf sandwort	33%	2.0	1.4	
ASCA3	western wild ginger	16%	1.0	.0	occurs on wetter sites
CLUN	queen's cup	33%	1.0	.0	generally on sites with frost and deep snowpack
COMA3	spotted coral-root	16%	1.0	0	
COST2	hooded coral-root	16%	1.0	.0	
DIHOO	Oregon fairybell	16%	1.0	.0	mid to late successional
FRVEB	woods strawberry	33%	2.0	1.4	
HAL	white-flowered hawkweed	33%	1.0	.0	
LIBOL	western twinflower	33%	2.0	0	abundance indicates relatively little soil drought
LICA3	northwest listera	33%	1.0	0	
OSCH	mountain sweet-root	33%	1.0	0	
POTEN		16%	1.0	0	
PTAN	woodland pinedrops	16%	1.0	0	
PYPI	whitevein pyrola	33%	1.0	0	
PYSE	one-sided pyrola	66%	1.8	1.0	cool, moist conifer forests
SMST	starry Solomon-plume	33%	3.0	2.8	generally cool sites
	TOTAL HERB	100%	7.7	4.6	
BROMU	brome spp.	33%	1.0	.0	
CAREX	sedge spp.	33%	2.0	1.4	
MESU	Alaska oniongrass	16%	1.0	.0	
	TOTAL GRASS	100%	1.8	1.8	

## WESTERN HEMLOCK SERIES

### *Tsuga heterophylla*

### TSHE

Western hemlock is of more northerly latitudes, but contributes to species diversity in the northern part of the area and is most common along the Coast. It is a tolerant climax species that seeds prolifically and tends to germinate best on organic soils or rotten logs. It associates with mountain hemlock at the upper elevational limits of its range, but is distinguished by its smaller cone and finer leaves. It quickly develops rot when injured.

Western hemlock has a bimodal distribution in western North America. The interior range, including northern Idaho, extends into British Columbia. The coastal range includes southeastern Alaska, through western Washington and Oregon west of the Cascade Mountain crest. In southwestern Oregon the distribution narrows, beginning at the Siskiyou Mountains, to the immediate Coast and extends to Eureka in northern California. In our area western hemlock occurs north of the Rogue-Umpqua Divide, on the Powers District, and scattered stands and patches south.

Western hemlock grows in cool, moderate, oceanic environments where moisture stress occurs late in the growing season, and temperature extremes are mild. Light does not often limit survival, but levels less than 10 percent of full sunlight can limit growth. It's as shade tolerant as Pacific silver fir (*Abies amabilis*) and Pacific yew (*Taxus brevifolia*) the three most tolerant species in the Pacific Northwest (Minore 1979). Yet, it grows well in full sunlight. It also seems to be tolerant of mild nutrient deficiencies.

Western hemlock grows slowly as it establishes itself, even if under full sunlight. Leader growth averages about two feet per year on good sites. However, because of its shade tolerance, high stocking levels can be sustained. Twenty-year-old stands can produce 2,600 cubic feet. At 100 years, board foot volume can be as high as 190 thousand per acre. A comparable Douglas-fir stand of similar site quality would produce 150 MBF.

## THE SERIES

The Western Hemlock Series is common throughout the Pacific Northwest where the species range coincides with the range of the series. In southwest Oregon, the coincidence is more tentative. Silver fir, white fir, Shasta red fir, mountain hemlock, western redcedar, and occasionally Douglas-fir compete for dominance. Most undisturbed sites are in mid-seral stage, still dominated by Douglas-fir overstory, but western hemlock is consistently increasing in the understory.

**EXTENT:** The Western Hemlock Series occurs at mid elevations on the Umpqua National Forest, occasionally interrupted by patches or fingers of other series as mentioned above. There may be a few scattered patches as far south as the Butte Falls Ranger District of the Rogue River National Forest. N = 211 plots.

**IDENTIFYING CHARACTERISTICS:** Series are defined by the dominant climax species, as indicated by the regeneration layer, since most undisturbed stands are only at mid seral stage of succession. It

is important to thoroughly investigate the site, particularly if it is in early seral condition to determine the series (see the discussion on keying disturbed sites and the classification concept presented earlier in the guide). Since TSHE is one of the most extensive series in the Cascades, it occurs on a wide variety of sites and in association with most species. Western hemlock consistently dominates the understory tree regeneration layer, although white fir, western redcedar, Douglas-fir, sugar pine, silver fir, Shasta red fir, and Pacific yew may be present in various combinations. On young sites, the cover of western hemlock may be slightly less than other understory species (ie 45/55 percent split) but the total complement of species, western redcedar, Pacific yew, salal, rhododendron, etc, may indicate the site is climax to western hemlock.

**ABIOTIC ENVIRONMENT:** Since the Series is so extensive, it tends to reflect the average Cascade site. It occurs on northerly, slightly steeper than average aspects with deep basaltic soils and exhibits no preference for slope position.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	1260	5760	4500	3331.0	833.0	
Aspect (deg)	--	--	--	356.9	111.6	
Slope (%)	0	96	96	33.4	21.4	
Total soil depth (in)	7.9	50.0	42.1	42.6	11.6	
Rooting depth (in)	15.7	50.0	34.3	46.5	8.0	
Total basal area (ft <sup>2</sup> /ac)	80	640	560	295.2	97.6	

**CLIMATE:** The Series generally occurs in a warm, moist moderate environment.

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	39.9	51.3	11.4	46.4	2.2	
Maximum month temp (F)	71.4	88.9	17.5	81.2	3.3	
Mean annual ppt (in)	40	75	35	60.5	7.8	
Dry season ppt (in)	6	10	4	8.2	1.1	

#### WESTERN HEMLOCK AND WESTERN REDCEDAR PLANT ASSOCIATIONS

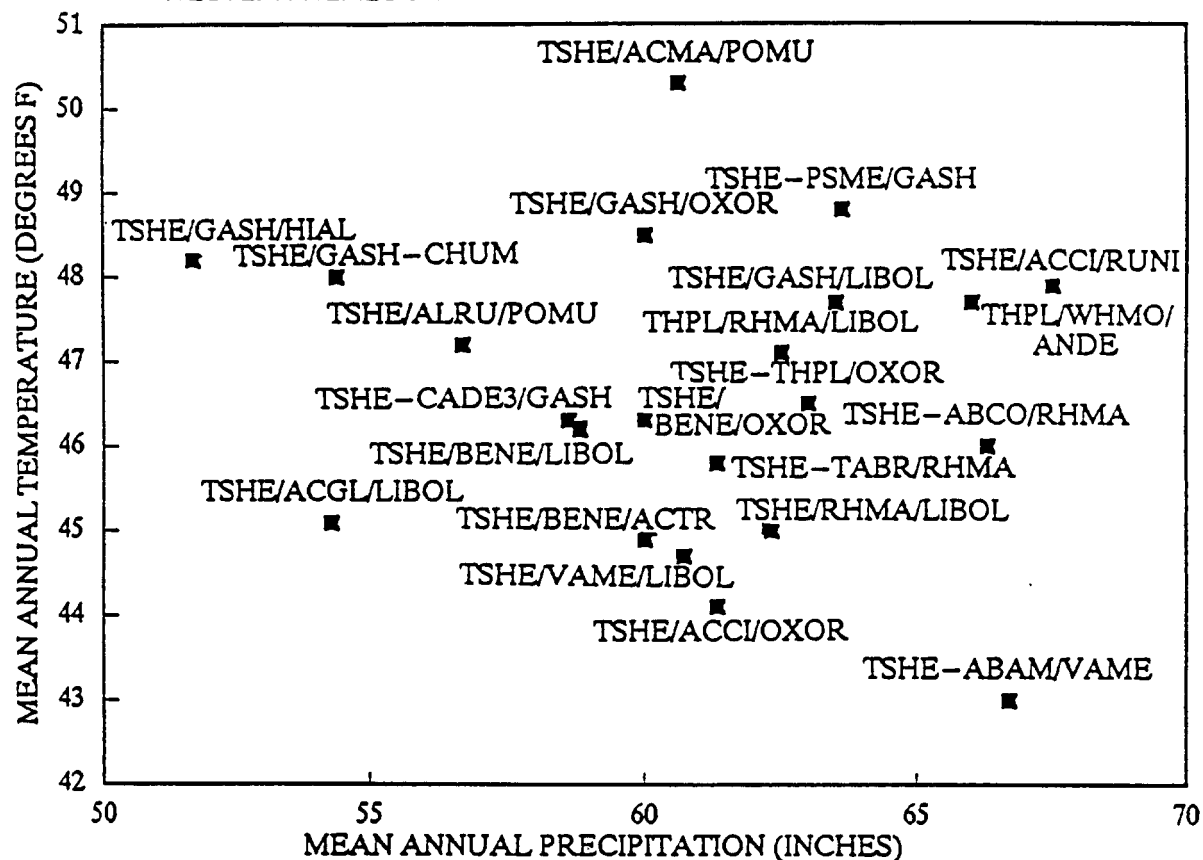


Figure 10. Ecograph of Western Hemlock and Western Redcedar Plant Associations.

**FOREST FLOOR:** One reason western hemlock sites are productive is the high rate of input and processing of coarse wood at the soil surface. Forest floor litter is produced readily from a variety of species and is incorporated into the soil quickly. Soils usually are rich in organic matter and the surface is composed of all sizes of material at various stages of decomposition. Rates of decomposition and incorporation are related to the temperature, moisture regime and the richness of nutrients in the litter. Rates on saturated, cold sites are slow. Warm, moist conditions are ideal. Associations such as the

TSHE-ACMA/POMU, TSHE-PSME/GASH, and TSHE/GASH/LIBOL would tend to have rapid decomposition rates, while TSHE-ABAM/VAME, TSHE/ACCI/OXOR, and TSHE/GASH/LIBOL wood would tend to decompose more slowly. The occurrence of moss generally is higher for the Series than the average Cascade site, most likely a result of slightly higher temperatures. Variability among the associations is low. Only differences will be highlighted in the association descriptions.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	10	100	90	89.4	19.5	
Moss (%)	0	99	99	22.6	25.0	
Bareground (%)	0	70	70	1.3	5.2	
Gravel (%)	0	25	25	1.7	3.4	
Rock (%)	0	80	80	3.6	8.4	
Bedrock (%)	0	40	40	1.1	5.1	

**VEGETATION:** Series on the extreme ends of the climatic gradient, the very cold lodgepole pine types or the pine-oak series, tend to have distinct breaks in environment and vegetation. Separation of plant associations is correspondingly obvious. However, differences between associations in mid gradient Series, such as TSHE and ABCO are much more subtle, but still based on differences in total composition and environment. More effort and awareness is required to successfully key to association.

Western hemlock is the dominant climax on all sites. A variety of species, including Western redcedar, white fir, Douglas-fir, incense-cedar, silver fir, and Shasta red fir occur in various combinations as co-climax species. Vine maple has a high constancy throughout the Series, as does salal, Pacific rhododendron, dwarf Oregongrape, and twinflower. Most older, undisturbed sites are mid seral and host a relatively stable species composition. Dwarf Oregongrape, Pacific rhododendron, salal, swordfern, twinflower, vanillaleaf, Oregon oxalis, and western prince's pine will be part of the climax vegetation. Douglas-fir, sugar pine, big-leaf maple, trailing blackberry, the huckleberries and *Ribes*, starflower, bracken fern, and the grasses are more seral in behavior. Western redcedar, big-leaf maple, Oregon oxalis, red alder, and vanillaleaf are common associates on wetter sites. Thin-leaved huckleberry, silver fir, western white pine, and vine maple indicate the cool sites, while Douglas-fir regeneration,

salal, whipplevine, incense-cedar, tall Oregongrape, and creambush ocean-spray indicate warm, dry sites.

**SILVICULTURE:** The potential for natural regeneration is high. Success rates are likely to be the highest on sites that support Oregon oxalis, twinflower, swordfern (wet site variety), vanillaleaf and threeleaf anemone. Sites with high risk of regeneration failure are indicated by the presence of poison oak, hairy honeysuckle, and tall Oregongrape. Salal and Pacific rhododendron are fickle as indicators within the Series. Artificial regeneration follows indications as above; the toughest sites to reforest artificially have the lowest probability of naturally seeding. The most reasonable approach for species selection is to use species that presently occupy the site. If the stands are at mid-seral stage, a practical rule of thumb would be to use the species in the overstory for regeneration, if even-aged management is used, or use the species in the understory, if uneven-aged techniques are planned. Such a gross approximation will need site specific fine tuning to get the best mix of species for maintaining site productivity and biological diversity.

Pacific rhododendron, vine maple, big-leaf maple, and red alder are potential competition. On occasion, salal, huckleberry, and *Ribes* can be competitive and physically impede planting. In managed stands, maintaining a closed canopy will reduce the

competitive vigor of understory shrubs. In addition, maintaining a healthy mix of crop trees will tend to more fully utilize site resources. Plants tend to utilize resources at different times and slightly different spatial niches. For example, western hemlock roots more extensively near the soil surface than does incense-cedar. Moreover, incense-cedar seems to be able to extract water later in the growing season than western hemlock. Generally a combination of crop trees will more fully utilize the site over time and space, leaving fewer resources for competitive shrubs. In the long run we must continue to examine the role of shrubs and the effect of reduced cover on ecosystem function. In existing natural stands corrective action (control) may be needed to attain desired stocking levels and growth rates. Closely follow the five step procedure and philosophy outlined in the "Vegetation Management Environmental Impact Statement". Before and after measurements on the crop trees are essential. Competition is likely to be most intense on water limited sites.

Some form of site preparation is more often necessary on the wettest sites of the Series. These sites usually have more cull material, slash, and shrubby vegetation and may be difficult to plant. If natural regeneration is planned, site preparation may be used to influence the mix of species. Generally the Western Hemlock Series with relatively more organic material on and in the soil can better tolerate intensive site preparation. The relative amount of duff consumed or displaced over the project area should be planned for and recorded.

**WATERSHED MANAGEMENT:** Associations are similar with respect to watershed characteristics, only the major differences will be listed in the association discussions. Management of the Western Hemlock Series is important in the Western Cascades. About 40 percent of the Cascade Province is the Western Hemlock Series. Elevationally the Series is centered at about 3,300 feet. and most sites face north. Elevation was one consideration in estimating rainfall, so they are loosely related. Average annual precipitation is approximately 61 inches with less than half falling as snow. Variation among associations is low. The lowest rainfall occurs on the TSHE/GASH/HIAL (52 inches); the highest occurs on TSHE/ACCI/RUNI (68 inches). Dry season rainfall averages about 8 inches or 13 percent of annual, and is more variable. Generally evapotranspirational demand is low. Soils generally are deep,

developed from basalts or andesites which have low susceptibility to erosion, have a high field capacity, and infiltration rates are moderate to high. Almost all associations have developed on erosional, rather than depositional surfaces on or near the lower third of the slope. On the average there are 2.3 streams within each half mile and slope lengths average about 2,000 feet. Vegetation cover is variable and abundant. Total cover, including all layers averages about 250 percent, with a range from 128 to 460 percent. Sites generally are not sensitive to management activities, are difficult to denude, and quick to recover. Riparian sites support ample cover, and shade and are stable. Plant species diversity is high, thus, there are many species to consider when planning revegetation or vegetation augmentation programs. The most likely candidates for revegetation of disturbed sites include: Douglas-fir, incense-cedar, ponderosa pine, cutting and transplants of big-leaf maple, trailing blackberry, salal, thin-leaved huckleberry, western starflower, woods strawberry, beargrass, leafy peavine, lupines, groundsel, western fescue, and Pacific brome.

**FIRE MANAGEMENT:** Although fire regimes vary by plant association as a result of subtle differences in stand history, structure, composition, and environmental conditions, there is a great deal of similarity among associations. Only the differences will be highlighted in the association descriptions.

The typical regime is low frequency, high intensity fire. Thirty five percent of the sampled stands had evidence of being burned. Low intensity underburning was evident (one stand had a 600 year old Douglas-fir with several fire scars), but most stands seemed to be even-aged, fire generated. However, on closer investigation, stand structure was found to be a complex mix of seemingly random age classes. Since three quarters of the stands had no evidence of burning, and the average age for the series is about 250 years, it is likely that the fire free period is at least that long. But evidence of mild burns does not last long. Nine dated scars ranged from 67 to 127 years before present. Typical TSHE sites are moist, cool, humid, mid to low elevations, face northeast, protected from desiccating winds, and receive rain from summer thundershowers. Fire is much less common than in many of the other series. However, fuels accumulate slowly, although decomposition rates are high, and vertical structure is often continuous on the relatively steep slopes. Thus, a series of dry years, coupled with a relatively

dry thunderstorm, provide the potential for an extensive, intense stand generating fire. Fire occurrence is loosely related to the presence and cover of several species. The more Douglas-fir, incense-cedar, golden chinquapin, Pacific madrone, and whipple vine, the greater the occurrence of fire. Cover of western redcedar, Oregon oxalis, Pacific yew, vine maple, Oregon boxwood, and queen's cup is related to low fire occurrence.

**RANGE AND WILDLIFE MANAGEMENT:** Shrub and herb cover average 70 percent and 40 percent respectively, an indication that both browse and forage production are potentially high. A variety of species is available, but little is known about seasonal preference. The huckleberries, *Rubus* species, mountain ash, ninebark, and serviceberry are commonly used. Herb use is more difficult to detect, but herb biomass is high. Shrubs provide ample hiding cover on most sites, and scattered

patches of pole size western hemlock regeneration commonly provide thermal cover in many associations. Wildlife habitat is richly diverse by mid-seral stage. The combination of tolerant and intolerant conifers and hardwoods provide structural and compositional diversity. Additionally, stands are not as frequently burned as in the White Fir or Douglas-fir Series.

**RECREATION AND VISUAL MANAGEMENT:** Generally these mid-elevation associations do not have distinctive recreational or visual features. They are slightly steeper than the average Cascade series (33 percent), brushy, and walking through can be arduous. Poisonous plants are uncommon. Poison oak only occurs on the driest associations and armed plants occur on the higher elevation associations.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	3%	1	25	24	9.6	9.4	
ABCO	white fir	30%	3	65	62	13.8	11.8	
ABMAS	Shasta red fir	3%	2	30	28	12.3	9.9	
CADE3	incense-cedar	21%	2	20	18	8.8	4.4	
PIJE	Jeffrey pine	0%	3	3	0	3.0	.0	
PILA	sugar pine	20%	1	30	29	10.0	7.0	
PIMO	western white pine	20%	1	28	27	8.2	6.7	
PIPO	ponderosa pine	2%	4	15	11	7.5	5.1	
PSME	Douglas-fir	98%	5	80	75	41.1	17.6	
THPL	western redcedar	12%	1	40	39	12.8	9.3	
TSHE	western hemlock	56%	3	80	77	20.4	16.0	
	TOTAL OVERSTORY	100%	20	130	110	64.2	17.9	
—CONIFERS—								
ABAM	Pacific silver fir	6%	1	45	44	19.4	15.8	
ABCO	white fir	59%	1	40	39	14.5	10.1	
ABMAS	Shasta red fir	1%	1	10	9	4.3	4.9	
CADE3	incense-cedar	35%	1	40	39	9.4	9.0	
PIEN	Engelmann spruce	0%	2	2	0	2.0	.0	
PILA	sugar pine	7%	1	10	9	2.1	2.4	
PIMO	western white pine	8%	1	5	4	3.1	1.7	
PSME	Douglas-fir	44%	1	50	49	12.7	11.7	
TABR	Pacific yew	56%	1	70	69	11.8	10.6	
THPL	western redcedar	27%	1	50	49	16.6	12.4	
TSHE	western hemlock	100%	5	110	105	38.9	23.8	
TSME	mountain hemlock	0%	25	25	0	25.0	.0	
—HARDWOODS—								
ACCI	vine maple	64%	1	90	89	26.3	21.1	
ACGL	Douglas maple	7%	1	33	32	5.5	8.4	
ACMA	big-leaf maple	13%	1	60	59	12.8	12.1	
ALRU	red alder	3%	1	15	14	5.2	5.1	
ARME	Pacific madrone	8%	1	17	16	6.4	4.4	
CACH	golden chinquapin	50%	1	75	74	8.9	12.1	
PREM	bittercherry	0%	2	2	0	2.0	.0	
QUCH	canyon live oak	1%	7	20	13	13.5	9.2	
	TOTAL UNDERSTORY	100%	27	213	186	93.9	32.9	

MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
AMAL	western serviceberry	11%	1	10	9	2.5	2.3	
ARCO3	hairy manzanita	0%	18	18	0	18.0	.0	
BENE	dwarf Oregongrape	94%	1	75	74	15.6	15.6	
BEPI	Piper's Oregongrape	3%	1	5	4	2.6	1.8	
CHME	little prince's-pine	21%	1	2	1	1.0	.2	
CHUM	common prince's-pine	66%	1	30	29	3.5	3.9	
CONU	Pacific dogwood	28%	1	60	59	8.9	9.8	
COST	red-osier dogwood	1%	1	5	4	2.7	2.1	
COCOC	California hazel	26%	1	35	34	5.7	6.2	
GAFR	Fremont silk-tassel	0%	2	2	0	2.0	.0	
GAOV	slender salal	7%	1	15	14	5.0	4.9	
GASH	salal	52%	1	100	99	31.5	30.8	
HODI	creambush ocean-spray	9%	1	40	39	7.8	10.9	
LOCI	trumpet honeysuckle	5%	1	2	1	1.2	.4	
LOHI	hairy honeysuckle	3%	1	2	1	1.3	.5	
OECE	Indian plum	2%	1	3	2	1.5	1.0	
PAMY	Oregon boxwood	22%	1	15	14	2.8	3.2	
PHCA3	Pacific ninebark	0%	1	1	0	1.0	.0	
RHPU	cascara	2%	1	2	1	1.2	.4	
RHMA	Pacific rhododendron	51%	1	130	129	35.7	31.3	
RHDI	poison oak	2%	1	2	1	1.4	.5	
RIBES	currant spp.	1%	1	2	1	1.5	.7	
RIBI	Siskiyou gooseberry	1%	1	2	1	1.5	.7	
RIER	Crater Lake currant	0%	7	7	0	7.0	0	
RILA	swamp gooseberry	3%	1	3	2	1.7	1.0	
RISA	red currant	1%	1	1	0	1.0	.0	
RIVI	sticky currant	0%	2	2	0	2.0	.0	
ROGY	baldhip rose	56%	1	15	14	2.4	2.1	
RULA	dwarf bramble	11%	1	10	9	2.7	2.4	
RULE	black raspberry	2%	1	1	0	1.0	.0	
RUNI	snow bramble	33%	1	25	24	4.4	4.7	
RUPA	thimbleberry	8%	1	6	5	2.4	1.8	
RUSP	salmonberry	1%	1	3	2	2.0	1.4	
RUUR	Pacific blackberry	73%	1	16	15	2.8	2.5	
SOSI	Sitka mountain-ash	1%	1	4	3	2.3	1.5	
SYAL	common snowberry	2%	1	3	2	1.8	.8	
SYMO	creeping snowberry	28%	1	50	49	4.1	7.3	
VAME	thin-leaved huckleberry	30%	1	30	29	3.4	4.2	
VAPA	red huckleberry	48%	1	30	29	3.9	4.8	
VASC	grouse huckleberry	0%	1	1	0	1.0	.0	
WHMO	whipplevine	42%	1	25	24	4.1	4.1	
	TOTAL SHRUB	100%	2	208	206	70.0	49.2	



- MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ACMI	common yarrow	0%	1	1	0	1.0	.0	
ACTR	vanillaleaf	56%	1	70	69	7.1	11.4	
ACRU	baneberry	3%	1	2	1	1.2	.4	
ADBI	trail-plant, pathfinder	35%	1	40	39	2.6	4.9	
ADCA	Venus-hair fern	0%	1	1	0	1.0	.0	
ADPE	northern maidenhair	2%	1	2	1	1.6	.5	
ALVI	candystick	1%	1	1	0	1.0	.0	
ANMA	common pearly- everlasting	0%	1	1	0	1.0	.0	
ANDE	threeleaf anemone	44%	1	7	6	1.6	1.1	
ANLY2	Lyall anemone	1%	1	1	0	1.0	.0	
APAN	spreading dogbane	0%	1	1	0	1.0	.0	
AQFO	Sitka columbine	0%	1	1	0	1.0	.0	
ARMA3	bigleaf sandwort	6%	1	2	1	1.1	.3	
ARCO	heart-leaf arnica	0%	1	1	0	1.0	.0	
ARLA	mountain arnica	2%	1	5	4	2.0	1.7	
ASCA3	western wild ginger	17%	1	5	4	1.8	1.2	
ASHA	marbled wild ginger	14%	1	7	6	1.7	1.4	
ASTR	maidenhair spleenwort	1%	1	1	0	1.0	.0	
BLSP	deer-fern	2%	1	3	2	2.2	.8	
CABU2	fairy-slipper	2%	1	1	0	1.0	.0	
CAPR3	California harebell	2%	1	2	1	1.2	.4	
CASC2	rough harebell	17%	1	7	6	1.7	1.4	
CIAL	alpine circaea	1%	1	4	3	2.5	2.1	
CLUN	queen's cup	35%	1	12	11	2.0	1.8	
COHE	varied-leaved collomia	1%	1	1	0	1.0	.0	
CONY	night-blooming morning- glory	0%	1	1	0	1.0	.0	
COLA	cutleaf goldthread	24%	1	20	19	3.1	3.6	
CORAL	coral-root	0%	1	1	0	1.0	.0	
COMA3	spotted coral-root	11%	1	1	0	1.0	.0	
COME	Pacific coral-root	9%	1	1	0	1.0	.0	
COST2	hooded coral-root	5%	1	1	0	1.0	.0	
COCA	bunchberry	4%	1	10	9	3.9	3.3	
CYGR	Pacific hound's-tongue	0%	3	3	0	3.0	.0	
DIFO	Pacific bleedingheart	1%	1	3	2	1.7	1.2	
DIHOO	Oregon fairybell	53%	1	15	14	1.4	1.5	
EBAU	phantom-orchid	1%	1	1	0	1.0	.0	
EPAN	fireweed	2%	1	5	4	2.3	1.9	
EPMI	small-fld willow-herb	1%	1	1	0	1.0	.0	
EPPA	autumn willow-herb	0%	1	1	0	1.0	.0	
EQUIS		0%	1	1	0	1.0	.0	
FRVEB	woods strawberry	12%	1	3	2	1.3	.6	
GAAP	catchweed bedstraw	35%	1	4	3	1.2	.5	
GAOR	Oregon bedstraw	6%	1	2	1	1.2	.4	
GATR	fragrant bedstraw	2%	1	1	0	1.0	.0	
GOOB	rattlesnake-plantain	69%	1	5	4	1.2	.5	
HAUN	Alaska bog-orchid	0%	1	1	0	1.0	.0	
HECO	gnome-plant	5%	1	1	0	1.0	.0	
HEMI	smallflower alumroot	3%	1	5	4	2.3	1.7	
HIAL	white-flowered hawkweed	35%	1	10	9	1.4	1.2	
HYMO	fringed pinesap	4%	1	1	0	1.0	.0	
IRIS	iris spp.	1%	1	1	0	1.0	.0	
IRCH	slender-tubed iris	2%	1	1	0	1.0	.0	
LATHY		0%	1	1	0	1.0	.0	
LAPO	leafy peavine	8%	1	5	4	2.2	1.5	
LICO4	tiger lily	1%	1	1	0	1.0	.0	
LIWA	Washington lily	1%	1	1	0	1.0	.0	
LIBOL	western twinflower	85%	1	75	74	11.8	14.6	
LICA3	northwest listera	5%	1	1	0	1.0	.0	
MAMA	woodland tarweed	2%	1	1	0	1.0	.0	
MITEL		0%	1	1	0	1.0	.0	
MITR2	three-tooth mitrewort	1%	1	1	0	1.0	.0	
MOUN2	Indian-pipe	9%	1	2	1	1.1	.2	
MOPE	miner's lettuce	0%	1	1	0	1.0	.0	
MOSI	candyflower	7%	1	3	2	1.4	.6	

NEHE	small white nemophila	2%	1	2	1	1.2	.4
OSCH	mountain sweet-root	13%	1	5	4	1.5	1.1
OXOR	Oregon oxalis	18%	1	75	74	19.4	20.6
PERA	leafy lousewort	9%	1	30	29	5.6	8.7
PENST		0%	1	1	0	1.0	.0
PECA3	Cardwell's penstemon	0%	1	1	0	1.0	.0
PEOV	broad-leaved penstemon	1%	1	2	1	1.5	.7
PEWI	Wilcox's penstemon	1%	1	1	0	1.0	.0
PEFR2	sweet coltsfoot	0%	1	1	0	1.0	.0
PHLOX		0%	1	1	0	1.0	.0
PHAD	woodland phlox	7%	1	2	1	1.2	.4
PHSP	showy phlox	0%	1	1	0	1.0	.0
PICA	pine-foot	0%	1	1	0	1.0	.0
PLFI	fragrant popcorn-flower	1%	1	2	1	1.3	.6
POHE	dwarf desert knotweed	1%	1	1	0	1.0	.0
POGL4	licorice-fern	1%	1	1	0	1.0	.0
POMU	western sword-fern	56%	1	80	79	9.0	15.5
POTEN		0%	1	1	0	1.0	.0
PTAQ	bracken	27%	1	10	9	2.4	2.1
PTAN	woodland pinedrops	6%	1	1	0	1.0	.0
PYAP	leafless pyrola	2%	1	1	0	1.0	.0
PYAS	alpine pyrola	9%	1	5	4	1.3	.9
PYDE	toothleaf pyrola	0%	1	1	0	1.0	.0
PYPI	whitevein pyrola	29%	1	3	2	1.2	.5
PYSE	one-sided pyrola	14%	1	3	2	1.3	.6
SADO	yerba buena	2%	1	5	4	2.2	1.6
SAXIF	saxifrage spp.	1%	1	5	4	3.0	2.8
SESP	spatula-leaf stonecrop	0%	1	1	0	1.0	.0
SEBO	Bolander's groundsel	6%	1	4	3	1.2	.8
SMRA	western false Solomon's-seal	11%	1	2	1	1.2	.4
SMST	starry Solomon-plume	28%	1	15	14	3.0	3.5
STRO	rosy twisted-stalk	0%	1	1	0	1.0	.0
SYRE	snow-queen	36%	1	7	6	1.6	1.2
THMO	mountain thermopsis	1%	1	2	1	1.5	.7
TITR	foamflower	32%	1	15	14	2.6	2.7
TRLA2	western starflower	57%	1	10	9	1.6	1.3
TRIFO		0%	1	1	0	1.0	.0
TROV	white trillium	68%	1	5	4	1.2	.6
VAHE	white inside-out-flr	37%	1	10	9	2.1	1.9
VECA	Calif. false hellebore	1%	1	2	1	1.3	.6
VIAM	American vetch	4%	1	2	1	1.1	.3
VIAD	early blue violet	5%	1	6	5	2.2	1.6
VIGL	stream violet	30%	1	4	3	1.5	.7
VIOR2	round-leaved violet	37%	1	7	6	1.4	1.0
VISE	redwoods violet	3%	1	5	4	2.0	1.5
XETE	common beargrass	12%	1	85	84	8.3	17.0
	TOTAL HERB	100%	1	183	182	41.0	32.9
BROMU	brome spp.	1%	1	1	0	1.0	.0
BRER	meadow brome	2%	1	3	2	1.8	1.0
BRPA	Pacific brome	10%	1	5	4	1.4	1.0
BRVU	Columbia brome	1%	1	1	0	1.0	.0
CAREX	sedge spp.	4%	1	2	1	1.1	.3
DEEL	slender hairgrass	0%	1	1	0	1.0	.0
FESTU	fescue spp.	3%	1	1	0	1.0	.0
FEEL	meadow fescue	0%	1	1	0	1.0	.0
FEID	Idaho fescue	0%	1	1	0	1.0	.0
FEOC	western fescue	20%	1	2	1	1.0	.2
FEPA	Pacific fescue	0%	1	1	0	1.0	.0
FERU	red fescue	1%	1	1	0	1.0	.0
FESU	bearded fescue	3%	1	2	1	1.2	.4
FESU2	bearded fescue	0%	1	1	0	1.0	.0
JUNCU	rush spp.	0%	1	1	0	1.0	.0
LUCA2	tailcup lupine	1%	1	1	0	1.0	.0
LUHI	smooth woodrush	0%	1	1	0	1.0	.0
LUPA	smallflowered woodrush	2%	1	3	2	1.4	.9
MELIC		0%	1	1	0	1.0	.0
MESU	Alaska oniongrass	2%	1	3	2	1.4	.9
	TOTAL GRASS	100%	0	5	5	.8	1.0

## WESTERN HEMLOCK KEY

- |     |  |                     |
|-----|--|---------------------|
| 1a  | Western redcedar [THPL] present.   | 2                   |
| 1b  | Western redcedar [THPL] absent.  | 6                   |
|     |  |                     |
| 2a  | Big-leaf maple [ACMA] with more than 2% cover.   | TSHE-ACMA/POMU      |
| 2b  | Big-leaf maple [ACMA] absent or minor (less than 2% cover).  | 3                   |
|     |  |                     |
| 3a  | Oregon oxalis [OXOR] present.  | 4                   |
| 3b  | Oregon oxalis [OXOR] absent.   | 5                   |
|     |  |                     |
| 4a  | Snow bramble [RUNI] present, dwarf Oregongrape [BENE] with more than 5% cover.   | TSHE/ACCI/RUNI      |
| 4b  | Snow bramble [RUNI] absent, dwarf Oregongrape [BENE] absent or minor (less than 5% cover).   | THSE-THPL/OXOR      |
|     |  |                     |
| 5a  | Douglas-fir [PSME] present in understory.  | TSHE-PSME/GASH      |
| 5b  | Douglas-fir [PSME] absent from understory.   | TSHE/GASH/LIBOL     |
|     |  |                     |
| 6a  | Pacific silver fir [ABAM] understory with more than 5% cover.  | TSHE-ABAM/VAME      |
| 6b  | Pacific silver fir [ABAM] absent from understory or minor (less than 5% cover).  | 7                   |
|     |  |                     |
| 7a  | Oregon oxalis [OXOR] present.  | 8                   |
| 7b  | Oregon oxalis [OXOR] absent.   | 10                  |
|     |  |                     |
| 8a  | Thin-leaved huckleberry [VAME] present.  | TSHE/ACCI/OXOR      |
| 8b  | Thin-leaved huckleberry [VAME] absent.   | 9                   |
|     |  |                     |
| 9a  | Salal [GASH] with more than 5% cover.  | TSHE/GASH/OXOR      |
| 9b  | Salal [GASH] absent or minor (less than 5% cover).   | TSHE/BENE/OXOR(SWO) |
|     |  |                     |
| 10a | Red alder [ALRU] present.  | TSHE-ALRU/POMU      |
| 10b | Red alder [ALRU] absent.   | 11                  |
|     |  |                     |
| 11a | Rocky Mountain maple [ACGL] and starry false Solomon's-seal [SMST] present. Salal [GASH] and Pacific rhododendron [RHMA] absent.   | TSHE/ACGL/LIBOL     |
| 11b | Rocky Mountain maple [ACGL] or starry false Solomon's-seal [SMST] absent. Salal [GASH] or Pacific rhododendron [RHMA] commonly with more than 20% and 50% cover, respectively. | 12                  |

12a	Western white pine [PIMO] present in both layers (understory component may be in the form of intermediate, suppressed, or seeds/saplings). Oregon boxwood [PAMY] <i>and</i> thin-leaved huckleberry [VAME] present.	TSHE/VAME/LIBOL
12b	Western white pine [PIMO] absent, or present in <i>only</i> one layer. Either Oregon boxwood [PAMY] absent or thin-leaved huckleberry [VAME] or both absent.	13
13a	Salal [GASH] with more than 20% cover <i>and</i> Pacific rhododendron [RHMA] with more than 10% cover. Golden chinquapin [CACH] present.	14
13b	Salal [GASH] absent or minor (less than 20% cover) <i>or</i> Pacific rhododendron [RHMA] absent or minor (less than 10% cover). Golden chiquapin [CACH] absent.	15
14a	Pacific yew [TABR] present.	TSHE-TABR/RHMA
14b	Pacific yew [TABR] absent.	TSHE-CADE3/GASH
15a	Salal [GASH] with more than 20% cover.	16
15b	Salal [GASH] absent or minor (less than 20% cover).	18
16a	Pacific rhododendron [RHMA] with more than 15% cover.	TSHE-ABCO/RHMA
16b	Pacific rhododendron [RHMA] absent or minor (less than 15% cover).	17
17a	Common prince's-pine [CHUM] present.	TSHE/GASH-CHUM
17b	Common prince's-pine [CHUM] absent.	TSHE/GASH/HIAL
18a	Pacific rhododendron [RHMA] with more than 5% cover.	19
18b	Pacific rhododendron [RHMA] absent or minor (less than 5% cover).	20
19a	Incense-cedar [CADE3] with more than 10% understory cover.	TSHE-ABCO/RHMA
19b	Incense-cedar [CADE3] absent from understory or minor (less than 10% cover).	TSHE/RHMA/LIBOL(SWO)
20a	Vanillaleaf [ACTR] with more than 5% cover.	TSHE/BENE/ACTR(SWO)
20b	Vanillaleaf [ACTR] absent or minor (less than 5% cover).	TSHE/BENE/LIBOL

## WESTERN HEMLOCK ASSOCIATIONS

TSHE-ABAM/VAME pg. 109	Western hemlock - Pacific silver fir / Thin-leaved huckleberry <i>Tsuga heterophylla</i> - <i>Abies amabilis</i> / <i>Vaccinium membranaceum</i>
TSHE/VAME/LIBOL pg. 113	Western hemlock / Thin-leaved huckleberry / Western twinflower <i>Tsuga heterophylla</i> / <i>Vaccinium membranaceum</i> / <i>Linnaea borealis longiflora</i>
TSHE/RHMA/LIBOL (SWO) pg. 117	Western hemlock / Pacific rhododendron / Western twinflower (SWO) <i>Tsuga heterophylla</i> / <i>Rhododendron macrophyllum</i> / <i>Linnaea borealis longiflora</i>
TSHE-ABCO/RHMA pg. 122	Western hemlock - White fir / Pacific rhododendron <i>Tsuga heterophylla</i> - <i>Abies concolor</i> / <i>Rhododendron macrophyllum</i>
TSHE-TABR/RHMA pg. 126	Western hemlock - Pacific yew / Pacific rhododendron <i>Tsuga heterophylla</i> - <i>Taxus brevifolia</i> / <i>Rhododendron macrophyllum</i>
TSHE-CADE3/GASH pg. 130	Western hemlock - Incense-cedar / Salal <i>Tsuga heterophylla</i> - <i>Calocedrus decurrens</i> / <i>Gaultheria shallon</i>
TSHE/GASH/LIBOL pg. 134	Western hemlock / Salal / Western twinflower <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> / <i>Linnaea borealis longiflora</i>
TSHE-PSME/GASH pg. 138	Western hemlock - Douglas-fir / Salal <i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Gaultheria shallon</i>
TSHE/GASH-CHUM pg. 142	Western hemlock / Salal - Common prince's-pine <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> - <i>Chimaphilla umbellata</i>
TSHE/GASH/HIAL pg. 146	Western hemlock / Salal / White-flowered hawkweed <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> / <i>Hieracium albiflorum</i>
TSHE/ACGL/LIBOL pg. 150	Western hemlock / Douglas maple / Western twinflower <i>Tsuga heterophylla</i> / <i>Acer glabrum</i> / <i>Linnaea borealis longiflora</i>
TSHE/BENE/LIBOL pg. 154	Western hemlock / Dwarf Oregongrape / Western twinflower <i>Tsuga heterophylla</i> / <i>Berberis nervosa</i> / <i>Linnaea borealis longiflora</i>
TSHE/BENE/ACTR (SWO) pg. 159	Western hemlock / Dwarf Oregongrape / Vanillaleaf (SWO) <i>Tsuga heterophylla</i> / <i>Berberis nervosa</i> / <i>Achlys triphylla</i>
TSHE-ACMA/POMU pg. 163	Western hemlock - Big-leaf maple / Western sword-fern <i>Tsuga heterophylla</i> - <i>Acer macrophyllum</i> / <i>Polystichum munitum</i>
TSHE/ACCI/RUNI pg. 167	Western hemlock / Vine maple / Snow bramble <i>Tsuga heterophylla</i> / <i>Acer circinatum</i> / <i>Rubus nivalis</i>
TSHE-THPL/OXOR pg. 171	Western hemlock - Western redcedar / Oregon oxalis <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Oxalis oregana</i>

# WESTERN HEMLOCK ASSOCIATIONS (continued)

TSHE/ACCI/OXOR pg. 175	Western hemlock / Vine maple / Oregon oxalis <i>Tsuga heterophylla</i> / <i>Acer circinatum</i> / <i>Oxalis oregana</i>
TSHE/GASH/OXOR pg. 179	Western hemlock / Salal / Oregon oxalis <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> / <i>Oxalis oregana</i>
TSHE/BENE/OXOR (SWO) pg. 183	Western hemlock / Dwarf Oregongrape / Oregon oxalis (SWO) <i>Tsuga heterophylla</i> / <i>Berberis nervosa</i> / <i>Oxalis oregana</i>
TSHE-ALRU/POMU pg. 187	Western hemlock - Red alder / Western sword-fern <i>Tsuga heterophylla</i> - <i>Alnus rubra</i> / <i>Polystichum munitum</i>

# WESTERN HEMLOCK - PACIFIC SILVER FIR / THIN-LEAVED HUCKLEBERRY

*Tsuga heterophylla* - *Abies amabilis* / *Vaccinium membranaceum*

## TSHE-ABAM/VAME

**EXTENT:** TSHE-ABAM/VAME is found on the Umpqua National Forest in the Western Cascade geological province. The North Umpqua-South Umpqua Divide marks the sampled southern extent. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** Western hemlock and Pacific silver fir co-occur over a broad environmental range. Determining which is the climax dominant may sometimes be difficult. ABAM-TSHE/CLUN, the most similar association, differs in that Pacific silver fir is the dominant regenerating species, Shasta red fir is common in the overstory, its located on northeasterly aspects, and the climate is cooler and drier.

**ABIOTIC ENVIRONMENT:** Soils developed from Western Cascade andesites and basalts. Soil depth is more than 2 inches deeper than the Series average; rooting depths are one inch shallower. TSHE-ABAM/VAME occurs at the highest elevation within the Series, on northwesterly aspects, average slopes, and usually occurs on the upper to middle third of the slope. Microtopography is flat to convex. The Association supports more basal area than any other western hemlock plant association.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4584.0	601.0
Aspect (deg)	323.6	66.6
Slope (%)	31.9	17.7
Total soil depth (in)	44.8	7.3
Rooting depth (in)	45.5	10.5
Total basal area (ft <sup>2</sup> /ac)	392.5	96.8

**CLIMATE:** TSHE-ABAM/VAME is the coldest, wettest association of the Series. Late spring and early fall frost, and possibly low soil temperature, most limit biomass production. Moisture is available through most of the growing season, but can be limiting during dry years. Evapotranspirational demand is low, except on ridgetops or other sites commonly exposed to wind.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.0	1.7
Maximum month temp (F)	76.1	2.5
Mean annual ppt (in)	66.7	4.1
Dry season ppt (in)	9.2	1.0

**FOREST FLOOR:** Litter cover is above the Series average (89 percent). High litter cover and comparatively low moss cover indicates cooler temperatures, and associated low decomposition rates. Other forest floor variables are average for the Series.

FOREST FLOOR	MEAN	S.D.
Litter (%)	97.4	3.7
Moss (%)	6.6	7.3
Bareground (%)	.3	.5
Gravel (%)	1.3	1.9
Rock (%)	3.4	3.6
Bedrock (%)	.5	1.1

**VEGETATION:** Seven coniferous species occur in TSHE-ABAM/VAME. Western hemlock is the only one which is abundant in both overstory and under-story layers. Douglas-fir is abundant in the overstory, but rare in the regeneration layer; Pacific silver fir is the reverse. White fir, incense-cedar, western white pine, and Pacific yew are occasional or rare. This combination of species indicates Douglas-fir is the most efficient early successional species following even-age harvest. Establishment of western hemlock and Pacific silver fir tends to occur in partial shade of uneven-aged stands or under full canopy.

All plots have low shrub cover, averaging 18 percent. Thin-leaved huckleberry, dwarf Oregon grape, and common prince's-pine are the most common. A tall shrub canopy of vine maple and Pacific rhododendron occurs on about half of the plots. Herb cover is less than the Series average; foamflower and white trillium are the most common. Plant composition implies a cool, moist environment.

**SILVICULTURE:** Western hemlock, Douglas-fir, and Pacific silver fir are most appropriate for regen-

eration. The potential for natural seeding is high, especially hemlock and silver fir. Initial growth, and possibly establishment, may be retarded by snow-packs which last through late spring.

Overall biomass production is lowest of all western hemlock plant associations. Cool soil and air temperatures limit growth. Pacific rhododendron and vine maple are potential vegetation management problems. Where they occur (constancy is approximately 50 percent for each), initial growth rates of sprouts commonly exceed rates of newly planted conifers. Long-term effects on yield should be monitored and evaluated.

Most sites can be broadcast burned in the spring without soil resource damage. Soil moisture content of the duff and soil remains high through spring. Timing burning to minimize resprouting is likely to increase survival and early conifer growth. Silvicultural prescriptions should encourage Pacific yew for biological diversity, forest products, and medicinal use.

**WATERSHED MANAGEMENT:** Heavy snow and cool temperatures delay snow melt. Snow remains on some sites through spring. Most precipitation occurs in November through April, as snow. However, this Association receives more dry season precipitation than any other in the Series.

Sites are relatively stable; slopes are moderate, soil development and rooting is deep, significant amounts of litter cover the forest floor, and a well developed structure of vegetation exists in all layers to enhance precipitation interception and infiltration rates. Shrubby species which sprout after disturbance will be significant in protecting the site, particularly vine maple and Pacific rhododendron. With the presence of an adequate seed source, western hemlock and Douglas-fir regeneration after disturbance will be rapid and prolific.

**FIRE MANAGEMENT:** Only two of eight plots exhibited definite indications of past fire. Although lightning is relatively common, severe, extensive fires are rare. Low temperatures and moisture tend to dampen the spread. Most fires have been low intensity underburns, causing the mortality in true fir and western hemlock regeneration. Soil, litter, and

fuel moistures are above average for the Series and for the Forest.

Incense-cedar, Douglas-fir, and western white pine are the most fire resistant species present. Fire would have the effect of modifying the stand to uneven-aged structure, possibly with small inclusions of even-aged Douglas-fir and/or western hemlock and scattered fire resistant species. Burning patterns and mortality will be unevenly distributed throughout the stand. Initial stand development after a major disturbance favors Douglas-fir. True firs and western hemlock quickly invade, dependant on the proximity of a seed source, after the shrubs and early conifer regeneration dominate the site.

Fuel ladders and diverse vertical structure will impede suppression efforts. With succession, tolerant conifers and shrubs will fill understory voids and gradually increase risk and hazard. Vine maple and Pacific rhododendron are significant barriers to hand line construction.

**RANGE & WILDLIFE MANAGEMENT:** Foraging qualities in this association are limited. Total shrub and herb cover is less than the Province averages. Those species which are well represented, either by high covers or high constancy, are not well utilized by wildlife; and those that are well utilized are not well represented. Thin-leaved huckleberry does occur on 87 percent of the plots, but with covers less than 5 percent.

Stand structure provides near ideal hiding and thermal cover for big game. Understory and regeneration development is well represented in almost all layers. However, the stands probably do not get extensive use because of low forage availability and distance from significant water sources.

**RECREATION & VISUAL MANAGEMENT:** **TSHE-ABAM/VAME** is higher in elevation than the average **TSHE** association. The climate is cool, and the potential for interesting views is high. It occurs on the upper third of the slope, near prime road and trail locations.

Pacific rhododendron occurs on most sites and is particularly attractive during May-June flowering. Floristic diversity is high and flowering occurs throughout spring, but May and June, soon after snow melt, are exceptionally beautiful.



# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	37%	18.3	7.6	co-climax; increases in cooler sites
ABCO	white fir	25%	10.0	.0	seral species; may be appropriate for micro-sites
CADE3	incense-cedar	12%	10.0	.0	minor, seral species, fire resistant
PIMO	western white pine	12%	1.0	.0	seral; one occurrence of a Ribes species found
PSME	Douglas-fir	87%	35.7	18.4	seral
TSHE	western hemlock	62%	33.0	17.2	co-climax; increases on warmer sites
	TOTAL OVERSTORY	100%	62.6	21.6	typic of Series
ABAM	Pacific silver fir	100%	27.5	12.8	good for reforestation
ABCO	white fir	12%	12.0	0	be sure of your identification
CADE3	incense-cedar	12%	5.0	.0	
PIMO	western white pine	12%	3.0	.0	appropriate for micro sites where Ribes is not present
PSME	Douglas-fir	12%	5.0	.0	good growth potential
TABR	Pacific yew	12%	20.0	.0	slow grower; high diversity and maybe medicinal value
TSHE	western hemlock	100%	43.7	15.3	high potential for natural regeneration
ACCI	vine maple	50%	18.7	8.5	sprouter; should be given vegetation management consideration
CACH	golden chinquapin	12%	7.0	.0	minor occurrence; indicates shallower soils
	TOTAL UNDERSTORY	100%	87.1	25.3	slightly less than the Series average
BENE	dwarf Oregongrape	62%	4.0	1.9	indicates better sites
CHME	little prince's-pine	12%	1.0	0	
CHUM	common prince's-pine	75%	1.3	5	common
COCOC	California hazel	12%	1.0	.0	
HODI	creambush ocean-spray	12%	2.0	.0	warmer sites
PAMY	Oregon boxwood	37%	1.0	.0	
RHMA	Pacific rhododendron	50%	16.2	10.3	possible vegetation management concern
RILA	swamp gooseberry	12%	1.0	.0	avoid western white pine reforestation
ROGY	baldhip rose	25%	1.0	.0	
RULA	dwarf bramble	62%	2.8	2.9	common
RUNI	snow bramble	25%	1.0	.0	indicates cooler sites
RUUR	Pacific blackberry	50%	2.0	1.4	good for soil stabilization
SYAL	common snowberry	12%	1.0	0	
SYMO	creeping snowberry	12%	1.0	.0	disturbance indicator
VAME	thin-leaved huckleberry	87%	2.1	1.1	common, although with low covers
	TOTAL SHRUB	100%	17.5	10.5	significantly less than the Series mean; lowest of Series
ACTR	vanillaleaf	62%	7.4	12.7	common
ADBI	trail-plant, pathfinder	25%	1.5	.7	
ANDE	threeleaf anemone	37%	1.7	1.2	common, mesic sites
ASCA3	western wild ginger	25%	1.5	.7	
CLUN	queen's cup	37%	2.0	1.0	indicates cool, moist sites
COLA	cutleaf goldthread	12%	1.0	.0	
COME	Pacific coral-root	50%	1.0	0	
COCA	bunchberry	12%	2.0	.0	indicates cool, mesic sites
DIFO	Pacific bleedingheart	12%	1.0	.0	
DIHOO	Oregon fairybell	37%	1.0	.0	
FRVEB	woods strawberry	12%	1.0	.0	
GAAP	catchweed bedstraw	12%	1.0	.0	
GOOB	rattlesnake-plantain	37%	1.3	.6	
HECO	gnome-plant	12%	1.0	.0	
HIAL	white-flowered hawkweed	12%	2.0	.0	indicates warm, dry sites
LIBOL	western twinflower	62%	3.2	1.3	ubiquitous
MOSI	candyflower	25%	1.5	.7	indicates moist sites
OSCH	mountain sweet-root	12%	1.0	.0	
OXOR	Oregon oxalis	37%	9.3	5.1	indicates warm, moist sites
POMU	western sword-fern	25%	2.5	.7	
PTAQ	bracken	50%	2.0	2.0	
PYPI	whitevein pyrola	37%	1.3	.6	
PYSE	one-sided pyrola	12%	1.0	.0	cool environment
SMRA	western Solomon-plume	12%	1.0	.0	
SMST	starry Solomon-plume	37%	1.7	.6	
SYRE	snow-queen	25%	1.0	.0	
TITR	foamflower	87%	1.9	.9	indicates moist environment
TRLA2	western starflower	37%	1.3	.6	
TROV	white trillium	87%	1.0	.0	part of the mesic middle indicators
VAHE	white inside-out-flower	50%	1.8	.5	part of the mesic middle indicators
VIGL	stream violet	50%	1.0	.0	
VIOR2	round-leaved violet	12%	1.0	.0	
XETE	common beargrass	12%	85.0	.0	
	TOTAL HERB	100%	31.7	28.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BROMU	brome spp.	12%	1.0	.0	average for Series
LUPA	smallflowered woodrush	12%	3.0	.0	
	TOTAL GRASS	100%	.5	1.1	

**WESTERN HEMLOCK / THIN-LEAVED HUCKLEBERRY / WESTERN TWINFLOWER**  
*Tsuga heterophylla* / *Vaccinium membranaceum* / *Linnaea borealis longiflora*  
**TSHE/VAME/LIBOL**

**EXTENT:** TSHE/VAME/LIBOL occurs on the Rogue River National Forest on the Prospect Ranger District, but is occasionally found on the Butte Falls Ranger District and the Diamond Lake Ranger District of the Umpqua NF. It is most commonly associated with the High Cascade Subprovince. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** High elevation sites support a complement of cold-adapted species, including western white pine, Oregon boxwood, Pacific yew, thin-leaved huckleberry, and slender salal. The pine and huckleberry are most indicative of the association. TSHE/VAME/LIBOL is similar to TSHE/VAME/XETE on the Mt. Hood National Forest (Halverson et al. 1986) which is much colder than our own.

**ABIOTIC ENVIRONMENT:** Elevation is only slightly higher than the Cascade average of 3,870 feet, but the typical northerly aspects receive little direct radiation and remain cool. Slopes are gentle, parent rock is usually basalt or andesite or rarely some combination of pumice or ash, and soils are deep, fertile, and stable.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3933.0	277.0
Aspect (deg)	349.2	61.4
Slope (%)	22.0	19.7
Total soil depth (in)	42.1	13.5
Rooting depth (in)	46.8	8.5
Total basal area (ft <sup>2</sup> /ac)	325.7	78.9

**CLIMATE:** Average annual temperature and average maximum summer temperature are cooler than the average Cascade site. Rainfall, both annual average and average dry season, are higher than the Cascade average. Relative to the Series, the site is considered cool and wet. However, compared to all Cascade sites, it is only slightly cooler than average. Either moisture or low temperature, or both, may limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.7	.9
Maximum month temp(F)	78.8	1.2
Mean annual ppt (in)	60.7	8.9
Dry season ppt (in)	8.4	.8

**FOREST FLOOR:** Forest floor conditions are similar to the Western Hemlock Series average where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 4 percent. Moss cover on TSHE/VAME/LIBOL is somewhat less than average because of the cold temperatures.

FOREST FLOOR	MEAN	S.D.
Litter (%)	97.7	3.5
Moss (%)	3.6	4.0
Bareground (%)	.1	.4
Gravel (%)	.4	.5
Rock (%)	.7	1.0
Bedrock (%)	.0	.0

**VEGETATION:** Western white pine and thin-leaved huckleberry are indicators of cool environments, and both thrive after disturbance. In fact, huckleberry production is stimulated by fire or other disturbances such as windthrow, disease, insects and harvest. The presence of Pacific yew is related to late seral stages. It indicates pockets of high humidity. Slender salal, absent in most other associations of the Series, is associated with cool, dry conditions. The greater the cover of Shasta red fir and western white pine, the cooler the site. On the other hand, cover of Douglas-fir and golden chinquapin indicate warmer, drier conditions.

**SILVICULTURE:** Regeneration potential for TSHE/VAME/LIBOL is low for the Series. Temperature is the most limiting factor, followed by moisture, and unseasonal frost. Western hemlock, Douglas-fir, white fir, and Shasta red fir will produce well on most sites. Western white pine grows well on most sites and would be a productive choice if rust free. Specialists include: subalpine fir for the high elevation, cold, exposed sites; Engelmann spruce for frost prone drainages; mountain hemlock for the coldest, concave sites. Natural regeneration composition and density can be controlled by varying the intensity of disturbance. The further back succession is set, the higher the probability of getting pioneer species. Vegetation competition usually is not a threat to timber volume production. Thin-leaved huckleberry provides the most consistent shrub cover and competition. There are no operational

limitations, soils are deep and fertile, and slopes commonly gentle.

**WATERSHED MANAGEMENT:** The coldest Association of the Series, snow accumulation can exceed six feet and last well into spring. Shrub and herb cover averages over 100 percent. Western white pine, thin-leaved huckleberry, greenleaf manzanita, and cherry are viable choices for revegetation.

**FIRE MANAGEMENT:** Cooler than the Series average, as indicated by the presence of thin-leaved huckleberry and western white pine, TSHE/VAME/LIBOL had evidence of fire in 28 percent of sampled sites. Risk and hazard is likely to be lower than the average TSHE associations, but regimes are not unlike the typical regime described in the Series summary.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and cover is slightly lower than average for the Series. Browse consists of low covers of thin-leaved huckleberry, including the berries, but the major shrub cover consists of Pacific rhododendron. Forage cover averages about 32 percent, but not much

is known about preference or utilization. Range opportunities are transitory. After harvest, huckleberry and rhododendron increase, grasses usually are not aggressive. Structural diversity is about average; there is opportunity for ample production of both thermal and hiding cover. Fallen stems are common on the wetter sites and internal saturation, even during the summer and cool temperatures tends to reduce the rate of decay (saturation excludes the oxygen needed by some wood processing organisms).

**RECREATION & VISUAL MANAGEMENT:** Terrain conditions are about average for the Series and Cascades in general. Slopes are slightly flatter (22 percent), and the climate is relatively cool during the summer. Aspects generally are northerly and understory tree cover is about 20 percent greater than overstory cover. Some sites may produce harvestable crops of huckleberries. Pacific rhododendron and vine maple provide spring and fall color respectively. Herbaceous variety may sometimes be limited by the overwhelming cover and dominance of Pacific rhododendron and salal.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	57%	19.7	23.7	produces well on most sites the greater the cover, the cooler the site cold species, the greater the cover, the cooler the site  indicates warmer, drier conditions climax species
ABMAS	Shasta red fir	28%	13.5	2.1	
PIMO	western white pine	100%	14.9	6.1	
PIPO	ponderosa pine	14%	6.0	.0	
PSME	Douglas-fir	100%	20.9	14.3	
TSHE	western hemlock	42%	38.7	22.0	
	TOTAL OVERSTORY	100%	68.3	15.6	
---CONIFERS---					
ABCO	white fir	71%	8.6	6.3	pioneer after disturbance warmer, drier sites, fire resistant viable choice for revegetation  late seral, indicates pockets of high humidity produces well on most sites
ABMAS	Shasta red fir	28%	5.5	6.4	
CADE3	incense-cedar	28%	1.5	.7	
PIMO	western white pine	100%	3.6	1.6	
PSME	Douglas-fir	42%	6.3	1.5	
TABR	Pacific yew	85%	6.5	3.7	
TSHE	western hemlock	100%	31.7	15.6	
---HARDWOODS---					
ACGL	Douglas maple	14%	2.0	0	indicates moist, rocky sites indicates warmer, drier conditions
CACH	golden chinquapin	71%	6.6	3.3	
	TOTAL UNDERSTORY	100%	56.7	18.3	
AMAL	western serviceberry	28%	5.0	4.2	moderate climate
BENE	dwarf Oregongrape	85%	16.5	18.3	
CHUM	common prince's-pine	100%	6.7	4.2	warm sites, well-drained soils cool, dry conditions warmer, dry sites
CONU	Pacific dogwood	14%	3.0	.0	
COCOC	California hazel	42%	7.7	7.0	
GAOV	slender salal	57%	3.5	2.4	
GASH	salal	14%	3.0	.0	
LOCI	trumpet honeysuckle	28%	1.0	.0	cold species presence increases after harvest, provides spring color
PAMY	Oregon boxwood	100%	4.1	4.8	
RHMA	Pacific rhododendron	14%	70.0	.0	
RIER	Crater Lake currant	14%	7.0	.0	
ROGY	baldhip rose	42%	4.3	2.5	
RULA	dwarf bramble	57%	2.3	.5	cool to cold, moist sites cool, moist
RUNI	snow bramble	14%	1.0	.0	
RUPA	thimbleberry	14%	4.0	.0	warm sites
RUUR	Pacific blackberry	71%	4.0	3.3	
SOSI	Sitka mountain-ash	14%	4.0	.0	
SYMO	creeping snowberry	28%	5.5	6.4	
VAME	thin-leaved huckleberry	100%	8.9	9.6	
VASC	grouse huckleberry	14%	1.0	0	cold species, production stimulated by disturbance
	TOTAL SHRUB	100%	61.7	29.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	71%	13.2	10.3	common associate of TSHE on wetter sites
ADBI	trail-plant, pathfinder	28%	2.0	1.4	
ANDE	threeleaf anemone	57%	3.0	2.7	wet, cool sites
ARMA3	bigleaf sandwort	14%	1.0	.0	
ASCA3	western wild ginger	14%	1.0	.0	wetter sites
CLUN	queen's cup	100%	3.7	3.9	generally on sites with frost and deep snowpack
COMA3	spotted coral-root	14%	1.0	.0	
COME	Pacific coral-root	14%	1.0	.0	
COCA	bunchberry	42%	5.7	4.5	
DIHOO	Oregon fairybell	57%	1.3	.5	mid to late successional
FRVEB	woods strawberry	28%	1.0	.0	
GAAP	catchweed bedstraw	14%	1.0	.0	
GAOR	Oregon bedstraw	14%	2.0	.0	
GOOB	rattlesnake-plantain	57%	1.5	1.0	
HECO	gnome-plant	14%	1.0	.0	
HEMI	smallflower alumroot	42%	2.0	1.7	
HAL	white-flowered hawkweed	28%	1.0	.0	warm sites in openings
LISOL	western twinflower	100%	10.6	10.4	
LICA3	northwest listera	28%	1.0	.0	
OSCH	mountain sweet-root	42%	1.7	1.2	
PERA	leafy lousewort	28%	2.5	.7	
POMU	western sword-fern	14%	3.0	0	generally on productive sites
PTAQ	bracken	42%	2.0	1.0	
PYAS	alpine pyrola	28%	3.0	2.8	
PYPI	whitevein pyrola	28%	1.0	.0	
PYSE	one-sided pyrola	42%	1.3	.6	
SMST	starry Solomon-plume	57%	4.3	3.9	
SYRE	snow-queen	28%	1.0	.0	
TITR	foamflower	28%	5.0	.0	
TRLA2	western starflower	57%	2.5	1.9	
TROV	white trillium	71%	1.2	.4	moist sites
VAHE	white inside-out-flr	57%	3.8	1.5	
VIAD	early blue violet	14%	1.0	0	
VIGL	stream violet	42%	1.3	6	
VIOR2	round-leaved violet	42%	1.0	0	mesic sites
	TOTAL HERB	100%	48.4	27.8	
BRPA	Pacific brome	28%	1.0	0	
FEOC	western fescue	14%	1.0	0	
	TOTAL GRASS	100%	4	.5	

WESTERN HEMLOCK / PACIFIC RHODODENDRON / WESTERN TWINFLOWER (SWO)  
*Tsuga heterophylla* / *Rhododendron macrophyllum* / *Linnaea borealis longiflora*  
**TSHE/RHMA/LIBOL (SWO)**

**EXTENT:** TSHE/RHMA/LIBOL (SWO) occurs on all Ranger Districts on the Umpqua National Forest, and is most common on Tiller and North Umpqua. It is associated with the Umpqua Basin and the Western Cascade geological province. N = 30 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/RHMA/LIBOL (SWO) is difficult to distinguish from many of the other associations, because composition varies greatly. Western redcedar is absent and the presence of Pacific yew is constant, but that combination of species is not unique. The key efficiently separates TSHE/RHMA/LIBOL (SWO), but it is one of the last three associations keyed. It is similar to TSHE/RHMA/LIBO2 found in the Willamette National Forest (Hemstrom et al. 1987).

**ABIOTIC ENVIRONMENT:** Parent rock type is basalt and andesite. Occasionally granitics and metamorphic rocks are present. The granitics usually are drier and support less vegetation. Organic matter depends on stand history, the relative amount of tolerant and intolerant species present, and the temperature and moisture regimes. Elevation and slope are about average, and aspect usually is northerly.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3878.0	554.0
Aspect (deg)	341.5	89.8
Slope (%)	33.9	23.0
Total soil depth (in)	40.1	13.2
Rooting depth (in)	45.3	9.0
Total basal area (ft <sup>2</sup> /ac)	338.3	96.9

**CLIMATE:** TSHE/RHMA/LIBOL (SWO) is near the cool, moist end of the TSHE environmental grid. Annual and summer maximum temperatures are cooler than the Series average, and about the same as the Cascade average. Rainfall is higher than both the Cascade average and Series average. The most

limiting factor affecting biomass production is moisture.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.0	1.5
Maximum month temp(F)	79.0	2.2
Mean annual ppt (in)	62.3	6.5
Dry season ppt (in)	8.4	1.1

**FOREST FLOOR:** Forest floor conditions are similar to the Cascade average where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 23 percent. TSHE/RHMA/LIBOL (SWO) averages about 12 percent. There have been some suggestions in the literature that the presence of Pacific rhododendron may be related to nutritional problems. More work needs to be done to establish such a relationship if it exists.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.9	12.2
Moss (%)	12.1	15.6
Bareground (%)	1.2	2.5
Gravel (%)	2.7	5.9
Rock (%)	3.1	5.4
Bedrock (%)	.6	2.2

**VEGETATION:** TSHE/RHMA/LIBOL (SWO) has both warm and cool site indicators. Incense-cedar and Douglas-fir, particularly when it occurs in the understory, indicates the driest sites. Thin-leaved huckleberry occurs on the coolest sites, and western redcedar indicates the warm, moist sites. White fir, Douglas-fir, Pacific yew, vine maple, and Douglas maple will be abundant in late seral stages of succession.

**SILVICULTURE:** Regeneration potential for **TSHE/RHMA/LIBOL (SWG)** is moderate for the Series. Temperature is the most limiting factor, followed by moisture, and unseasonal frost. Western hemlock, Douglas-fir, white fir, and Shasta red fir will produce well on most sites. Western white pine grows extremely well on most sites and would be a productive choice if rust free. Specialists include: subalpine fir for the high elevation, cold, exposed sites; Engelmann spruce for frost prone drainages; mountain hemlock for the coldest, concave sites. Natural regeneration composition and density can be controlled by varying the intensity of disturbance. Vegetation competition usually is not a threat to timber volume production. Thin-leaved huckleberry provides the most consistent shrub cover and competition. There are no operational limitations, soils are deep and fertile, and slopes commonly gentle.

**WATERSHED MANAGEMENT:** Shrub and herb cover averages over 100 percent on slopes dissected by 3.3 streams per half mile, the most dissected Association in the Series. **TSHE/RHMA/LIBOL (SWO)** is typical of the Series (see the Series discussion related to watershed).

**FIRE MANAGEMENT:** Evidence of fire was found on 37 percent of sampled sites, slightly higher than the Series average of 35 percent. The driest sites

are indicated by the presence of whipplevine. Otherwise **TSHE/RHMA/LIBOL (SWO)** is similar to the average association.

**RANGE & WILDLIFE MANAGEMENT:** Opportunities for range use are lower than average for the Series. Shrub cover is dominated by Pacific rhododendron. It can reach 72 percent or higher on some sites. Some browse is provided by thin-leaved huckleberry, Oregon boxwood, and young Pacific dogwood. Forb cover averages less than 30 percent, but can be less than 3 percent on some sites. Not much is known about utilization or preference. Structural diversity is average for the Series.

**RECREATION & VISUAL MANAGEMENT:** Recreational and visual conditions are well within the average for the **TSHE** Series. Sites are relatively cool, moist and floristically rich. Elevations fall within 2400-4000 feet, slopes average near 33 percent, there usually are two ephemeral streams within each half mile, and the difference in elevation between the stream bottom and the ridgetop is about 600 feet on a 2000 foot long slope. Tree cover is two or more storied and dense, usually over 100 percent. On the average, site shrub cover totals about 70 percent. Most sites are midslope with no vistas, nor unusual visual variety.



# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	6%	5.0	0	cold, stable, even, protected conditions
ABCO	white fir	23%	7.7	3.7	co-climax species
ABMAS	Shasta red fir	6%	17.5	17.7	produces well on most sites
CADE3	incense-cedar	6%	10.0	.0	dry
PILA	sugar pine	6%	3.0	2.8	intermediate in light tolerance
PIMO	western white pine	36%	7.1	5.1	grows extremely well, careful of blister rust
PSME	Douglas-fir	100%	47.2	19.2	abundant in late seral stages
TSHE	western hemlock	60%	23.4	16.8	produces well on most sites
	TOTAL OVERSTORY	100%	68.1	15.8	
	—CONIFERS—				
ABAM	Pacific silver fir	10%	3.7	2.3	
ABCO	white fir	66%	10.8	6.7	
CADE3	incense-cedar	13%	4.5	3.3	indicates driest sites
PIMO	western white pine	16%	3.2	1.8	frost tolerant
PSME	Douglas-fir	26%	8.9	12.8	
TABR	Pacific yew	56%	16.8	12.7	abundant in late seral stages
THPL	western redcedar	3%	5.0	.0	wetter sites
TSHE	western hemlock	100%	41.6	26.1	moderately warm, wetter
TSME	mountain hemlock	3%	25.0	.0	colder sites
	—HARDWOODS—				
ACCI	vine maple	50%	24.4	10.4	provides fall color
ACGL	Douglas maple	6%	1.0	.0	abundant in late seral stages
CACH	golden chinquapin	56%	10.5	18.0	tolerant of rocky, well-drained soils
	TOTAL UNDERSTORY	100%	81.4	25.5	
AMAL	western serviceberry	6%	1.0	.0	
BENE	dwarf Oregongrape	93%	17.9	19.1	deep, fertile soils
BEPI	Piper's Oregongrape	3%	3.0	.0	drier, rocky, less productive sites than BENE
CHME	little prince's-pine	26%	1.0	0	
CHUM	common prince's-pine	83%	2.7	1.9	
CONU	Pacific dogwood	10%	8.0	10.4	has browse potential when young
COCOC	California hazel	3%	2.0	.0	warm sites, well-drained soils
GAOV	slender salal	13%	5.3	6.6	cool, moist
GASH	salal	26%	3.9	3.0	
HODI	creambush ocean-spray	3%	2.0	0	warm to dry sites, rocky, shallow soils
PAMY	Oregon boxwood	33%	1.9	1.3	moist, cool sites
RHMA	Pacific rhododendron	100%	36.7	33.5	
RIBI	Siskiyou gooseberry	3%	2.0	0	
RILA	swamp gooseberry	3%	3.0	.0	
ROGY	baldhip rose	60%	1.9	1.2	
RULA	dwarf bramble	16%	3.2	3.8	
RUNI	snow bramble	56%	5.4	4.7	
RUPA	thimbleberry	6%	3.0	2.8	
RUUR	Pacific blackberry	76%	2.0	1.0	
SOSI	Sitka mountain-ash	6%	1.5	.7	
SYAL	common snowberry	3%	1.0	0	
SYMO	creeping snowberry	20%	1.7	1.0	warm, dry slopes
VAME	thin-leaved huckleberry	60%	3.7	3.0	occurs on the coolest sites
VAPA	red huckleberry	56%	4.4	4.6	moist to dry sites
WHMO	whipplevine	30%	3.0	3.0	indicates the driest sites
	TOTAL SHRUB	100%	72.1	43.8	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	50%	7.6	17.4	on wetter sites
ACRU	baneberry	6%	1.0	.0	cold sites
ADBI	trail-plant, pathfinder	20%	1.8	1.2	
ALVI	candystick	3%	1.0	.0	
ANDE	threelf anemone	40%	1.2	.4	wet, cool sites
ANLY2	Lyall anemone	3%	1.0	.0	
ARMA3	bigleaf sandwort	6%	1.0	.0	
ARLA	mountain arnica	6%	1.5	.7	cool, moist sites
ASCA3	western wild ginger	13%	1.0	.0	
ASHA	marbled wild ginger	10%	1.3	.6	
BLSP	deer-fern	3%	2.0	0	moist site indicator
CAPR3	California harebell	3%	1.0	.0	
CASC2	rough harebell	26%	1.3	.7	
CIAL	alpine circaea	6%	2.5	2.1	
CLUN	queen's cup	30%	1.8	2.0	well-drained soils, cold
COHE	varied-leaved collomia	3%	1.0	.0	
COLA	cutleaf goldthread	13%	2.8	1.7	
COMA3	spotted coral-root	10%	1.0	.0	
COME	Pacific coral-root	10%	1.0	.0	
COST2	hooded coral-root	3%	1.0	.0	
COCA	bunchberry	6%	4.5	4.9	
DIHO0	Oregon fairybell	40%	1.3	7	
EBAU	phantom-orchid	3%	1.0	.0	
EPAN	fireweed	6%	3.0	2.8	disturbance species
EPPA	autumn willow-herb	3%	1.0	.0	
FRVEB	woods strawberry	3%	1.0	.0	warm sites in openings
GAAP	catchweed bedstraw	36%	1.4	7	
GAOR	Oregon bedstraw	6%	1.0	.0	
GOOB	rattlesnake-plantain	60%	1.1	.5	
HIAL	white-flowered hawkweed	33%	1.7	.8	
HYMO	fringed pinesap	10%	1.0	.0	
IRCH	slender-tubed iris	3%	1.0	0	
LAPO	leafy peavine	6%	2.0	.0	
LIBOL	western twinflower	83%	8.9	9.6	moist, cool environments
LICA3	northwest listera	3%	1.0	.0	
MOPE	miner's lettuce	3%	1.0	.0	
MOSI	candyflower	3%	1.0	.0	
OSCH	mountain sweet-root	10%	1.3	.6	
PERA	leafy lousewort	20%	10.5	13.3	
PEWI	Wilcox's penstemon	3%	1.0	.0	
PHAD	woodland phlox	13%	1.3	.5	
PLFI2	Sierra-sap	3%	1.0	.0	
POGL4	licnice-fern	3%	1.0	.0	
POMU	western sword-fern	33%	4.4	5.9	
PTAQ	bracken	20%	2.3	1.2	
PTAN	woodland pinedrops	3%	1.0	0	
PYAP	leafless pyrola	6%	1.0	0	
PYAS	alpine pyrola	26%	1.0	0	
PYPI	whitevein pyrola	36%	1.2	4	
PYSE	one-sided pyrola	23%	1.4	8	all flowers hang to one side of stem
SADO	yerba buena	3%	2.0	0	has unique smell
SAXIF	saxifrage spp.	3%	1.0	0	
SEBO	Bolander's groundsel	13%	1.0	0	
SMRA	western Solomon-plume	6%	1.0	.0	
SMST	starry Solomon-plume	23%	1.7	1.0	
SYRE	snow-queen	36%	1.3	9	
TITR	foamflower	43%	3.8	5.1	warm, moist indicator
TRLA2	western starflower	50%	1.1	.4	
TROV	white trillium	76%	1.3	9	
VAHE	white inside-out-flr	23%	2.1	1.7	warm, moist site
VIAD	early blue violet	6%	4.5	2.1	
VIGL	stream violet	43%	1.5	9	early successional
VIOR2	round-leaved violet	46%	1.3	8	mesic sites
XETE	common beargrass	13%	9.3	8.5	cold sites
	TOTAL HERB	100%	30.6	25.0	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BRER	meadow brome	6%	2.0	1.4	
BRPA	Pacific-brome	6%	1.5	.7	
CAREX	sedge spp.	3%	1.0	.0	
DEEL	slender hairgrass	3%	1.0	.0	
FESTU	fescue spp.	3%	1.0	.0	
FEOC	western fescue	13%	1.0	.0	
FEPA	Pacific fescue	3%	1.0	0	
FERU	red fescue	3%	1.0	.0	
MESU	Alaska oniongrass	3%	3.0	0	
	TOTAL GRASS	100%	7	1.1	

**WESTERN HEMLOCK - WHITE FIR / PACIFIC RHODODENDRON**  
*Tsuga heterophylla* - *Abies concolor* / *Rhododendron macrophyllum*  
**TSHE-ABCO/RHMA**

**EXTENT:** **TSHE-ABCO/RHMA** occurs on Diamond Lake and Tiller Ranger Districts of the Umpqua National Forest. It may occur sporadically on the Prospect and Butte Falls Ranger Districts of the Rogue River National Forest. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** Douglas-fir dominates the overstory. White fir, incense-cedar, and Douglas-fir occur in the understory. They constantly occur in the Association (see the vegetation table at the end of this description). The combination of salal, Pacific rhododendron, and whipplevine also mildly distinguish **TSHE-ABCO/RHMA**. It is similar to **TSHE/RHMA-GASH** and **TSHE/RHMA-BENE** groups throughout the Pacific Northwest.

**ABIOTIC ENVIRONMENT:** Parent rock is typical of the Cascade conditions. Andesite is the most common parent rock, however, **TSHE-ABCO/RHMA** also occurs on breccia and metamorphic igneous rocks. Soils are deep and rapidly accumulate organic matter. Douglas-fir, the dominant species, constantly drops needles and small branches from the lower crown. But with the high moisture, temperature regime decomposition rates are high. There are no operational constraints related to soils, slopes, or elevation. Most sites are typical of moderate Cascade sites.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3521.0	477.0
Aspect (deg)	69.9	85.4
Slope (%)	29.0	13.3
Total soil depth (in)	47.2	8.0
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	280.0	127.4

**CLIMATE:** The temperature regime is only slightly cooler than the average **TSHE** association. Maximum monthly temperature, 80.4 degrees F., is also slightly cooler and occurs in July. Rainfall is six inches higher than the average for the Series, but most falls during the wet season. Dry season precipitation differs by about an inch, which can significantly

affect growth and survival. Moisture is the most limiting factor affecting productivity.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.0	1.4
Maximum month temp(F)	80.4	1.9
Mean annual ppt (in)	66.2	4.4
Dry season ppt (in)	9.1	.8

**FOREST FLOOR:** Forest floor conditions are typical for the Series with litter (needles, leaves, branches and decomposing logs) covering about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 14 percent.

FOREST FLOOR	MEAN	S.D.
Litter (%)	92.7	17.3
Moss (%)	14.4	14.3
Bareground (%)	.5	.8
Gravel (%)	.4	.7
Rock (%)	1.3	1.9
Bedrock (%)	.0	.0

**VEGETATION:** **TSHE-ABCO/RHMA** is a transition between the two major series in the southern Oregon Cascades. Species diversity is high, species closely associated with both series commonly occur. Incense-cedar and sugar pine are more often associated with white fir, dry conditions, and extremes in weather. Pacific yew is more abundant in moist sites with high humidity, and is commonly an abundant component of the **TSHE** series. Sugar pine, Douglas-fir, and incense-cedar can behave either as climax or coclimax species or pioneers on disturbed sites. Sugar pine, although it has a high tolerance for basic parent rock types, often indicates the most productive white fir sites.

**SILVICULTURE:** White fir, incense-cedar, sugar pine, and Douglas-fir seem to be equally productive. Western hemlock will produce denser stands, but is not at its productive best as it would be on more northerly moister sites. Ponderosa pine and Jeffrey pine also occur on some sites. Ponderosa pine will survive well on any site, but will not sustain growth competing among other conifers after the early phases of growth. The use of Jeffrey pine is appropriate only on ultrabasic sites. On "normal" sites it produces wildlife trees. Yew is often part of natural stands and should be included to maintain species diversity. Potential for natural regeneration is moderate. Use of pioneers, or intolerant species, on harvested sites is totally appropriate. Golden chinquapin and Pacific madrone will pioneer most sites and will compete for resources with conifers. Vegetation management may be necessary to attain target growth rates if conifers are the preferred crop. Vine maple and snowbrush ceanothus may also require control.

**WATERSHED MANAGEMENT:** TSHE-ABCO/RHMA does not differ significantly from the Series description. Like other TSHE associations shrub and herb cover usually exceeds 100 percent and soils are well protected. Incense-cedar and twin-flower can be added to the list of species appropriate for revegetation of disturbed sites.

**FIRE MANAGEMENT:** Fifty percent of sampled sites had evidence of burning. The figure for the White Fir Series of the Siskiyou Province was similar at 47 percent. White Fir sites generally are productive, dry readily, support heavy fuel loads, and usually have continuous vertical structure. However, TSHE-ABCO/RHMA has slightly higher summer

and annual rainfall than the average TSHE association.

**RANGE & WILDLIFE MANAGEMENT:** Potential for developing domestic range use is low. Sites generally are steep and dominated by salal and Pacific rhododendron, with very little grass and low forage cover (30 percent). If lightly disturbed most sites return to salal and rhododendron cover. Intense disturbance is necessary for the maximum development of grasses. Forb cover can be as high as 85 percent, but not much is known about the use and preference of the native forbs. Big game may enjoy both hiding and thermal cover in most stands. Stands older than 100 years generally have diverse vertical structure. Browse diversity is poor. In most stands snags, downed logs, and coarse duff and debris provide structure for small mammals, rodents, and birds.

**RECREATION & VISUAL MANAGEMENT:** Recreational and visual conditions are well within the average for the TSHE Series. Sites are relatively cool, moist and floristically rich. Elevations fall within 2400-4000 feet, slopes average near 33 percent, there usually are two ephemeral streams within each half mile, and the difference in elevation between the stream bottom and the ridgetop is about 600 feet on a 2000 foot long slope. Tree cover is two or more storied and dense, usually over 100 percent. Blackberries quickly stabilize disturbed sites, provide edible fruit for man and other animals, and provide habitat for small mammals. Pacific rhododendron, visually pleasing, but difficult to walk through, is common. On the average, site shrub cover totals about 70 percent. Most sites are mid-slope with no vistas, nor unusual visual variety.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	75%	9.2	7.6	co-climax
CADE3	incense-cedar	75%	9.3	5.4	associated with dry conditions, extremes in weather
PIJE	Jeffrey pine	12%	3.0	.0	needs ultrabasic sites
PILA	sugar pine	62%	14.2	10.1	often indicates most productive white fir sites
PIPO	ponderosa pine	12%	15.0	.0	will survive well on any site
PSME	Douglas-fir	100%	38.5	11.7	climax, co-climax, or pioneer
TSHE	western hemlock	75%	10.0	6.8	will produce dense stands, but is not at it's productive best
	TOTAL OVERSTORY	100%	69.1	15.8	
ABCO	—CONIFERS— white fir	100%	24.4	9.0	warmer, stable, even, protected conditions
CADE3	incense-cedar	100%	13.9	4.9	can be a pioneer species
PILA	sugar pine	12%	1.0	.0	
PSME	Douglas-fir	75%	13.3	12.7	pioneer after disturbance
TABR	Pacific yew	62%	5.0	4.1	moist areas, include to maintain species diversity
TSHE	western hemlock	100%	26.2	19.4	warm, wetter
	—HARDWOODS—				
ACCI	vine maple	25%	22.5	24.7	wonderful red fall colors
CACH	golden chinquapin	12%	15.0	.0	will pioneer most sites and compete for resources with conifers
	TOTAL UNDERSTORY	100%	86.5	30.3	
AMAL	western serviceberry	12%	3.0	.0	indicates better sites
BENE	dwarf Oregongrape	100%	12.6	11.9	red-stemmed, smaller than CHUM
CHME	little prince's-pine	12%	1.0	.0	green-stemmed, larger than CHUM
CHUM	common prince's-pine	100%	3.4	1.8	pretty orange fruits
CONU	Pacific dogwood	37%	4.7	4.6	occurs at low elevations on warm sites
COCOC	California hazel	12%	2.0	0	
GASH	salal	62%	28.8	17.8	
HODI	creambush ocean-spray	12%	3.0	0	dry, warm sites, shallow soils
PAMY	Oregon boxwood	25%	1.5	.7	
RHMA	Pacific rhododendron	100%	31.7	24.4	visually pleasing in spring, difficult to walk through
ROGY	baidhip rose	87%	2.1	.9	berry high in vitamin C
RUNI	snow bramble	37%	5.0	3.0	
RUUR	Pacific blackberry	75%	2.5	1.4	stabilize soil, edible fruits
SYMO	creeping snowberry	37%	2.3	6	warm, dry slopes
VAME	thin-leaved huckleberry	12%	4.0	0	fruit makes the tastebuds happy
VAPA	red huckleberry	50%	1.5	1.0	
WHMO	whipplevine	75%	6.2	3.0	warmer, drier sites
	TOTAL SHRUB	100%	81.4	27.7	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	75%	6.0	9.3	common
ADBI	trail-plant, pathfinder	75%	1.7	1.6	
ANDE	threeleaf anemone	62%	2.6	1.8	common, mesic sites
ASCA3	western wild ginger	12%	2.0	.0	
ASHA	marbled wild ginger	12%	2.0	.0	
CASC2	rough harebell	25%	1.5	.7	
CLUN	queen's cup	75%	1.7	.8	cool, moist sites
COLA	cutleaf goldthread	12%	4.0	.0	
COMA3	spotted coral root	12%	1.0	.0	
DIHOO	Oregon fairybell	87%	1.4	1.1	
FRVEB	woods strawberry	25%	1.0	.0	
GAAP	catchweed bedstraw	25%	1.0	.0	
GAOR	Oregon bedstraw	25%	1.5	.7	
GOOB	rattlesnake-plantain	62%	1.0	.0	
HECO	gnome-plant	12%	1.0	.0	
HAL	white-flowered hawkweed	12%	1.0	.0	indicates dry, warm sites
LAPO	leafy peavine	25%	1.5	.7	
LIBOL	western twinflower	100%	7.4	5.7	good for revegetating disturbed sites
LICA3	northwest listera	12%	1.0	.0	
MOSI	candyflower	12%	1.0	.0	
OSCH	mountain sweet-root	12%	1.0	.0	
PHAD	woodland phlox	12%	1.0	.0	
POMU	western sword-fern	50%	1.5	.6	
PTAQ	bracken	12%	2.0	.0	
PTAN	woodland pinedrops	25%	1.0	.0	
PYAS	alpine pyrola	12%	1.0	.0	
PYPI	whitevein pyrola	12%	1.0	.0	
PYSE	one-sided pyrola	12%	2.0	.0	
SADO	yerba buena	25%	3.5	2.1	hot, dry sites
SMRA	western false Solomon's-seal	12%	1.0	.0	
SMST	starry Solomon-plume	25%	3.5	3.5	
SYRE	snow-queen	62%	1.4	.5	
TITR	foamflower	25%	2.5	.7	indicates moist environment
TRLA2	western starflower	100%	1.4	.5	
TRIFO		12%	1.0	.0	
TROV	white trillium	75%	1.0	.0	moist sites
VAHE	white inside-out-flr	62%	1.4	.5	
VIAD	early blue violet	12%	1.0	.0	
VIGL	stream violet	62%	1.8	.8	warm, moist indicator
VIOB2	round-leaved violet	37%	2.0	.0	mesic sites
XETE	common beargrass	37%	1.7	.6	
	TOTAL HERB	100%	30.7	23.9	
FEID	Idaho fescue	12%	1.0	.0	
FEOC	western fescue	25%	1.0	.0	
MESU	Alaska oniongrass	25%	1.0	.0	
	TOTAL GRASS	100%	1.3	.7	

**WESTERN HEMLOCK - PACIFIC YEW / PACIFIC RHODODENDRON**  
*Tsuga heterophylla* - *Taxus brevifolia* / *Rhododendron macrophyllum*  
**TSHE-TABR/RHMA**

**EXTENT:** TSHE-TABR/RHMA occurs on the Tiller and North Umpqua Ranger Districts and is likely to occur on the Cottage Grove Ranger District. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** The complement of plants and environmental conditions is typical of the Series, except for the consistent presence of Pacific yew, vine maple, and golden chinquapin in the understory. Red huckleberry is often present, but not with high coverage. TSHE-TABR/RHMA is most similar to TSHE/RHMA sites, particularly those on the Willamette National Forest.

**ABIOTIC ENVIRONMENT:** Parent rock type is typical of the Cascade condition. Basalt and andesite are the most common parent rock, followed by pumice and ash. All gradations between both andesite and basalt, and ash and pumice may be present (See the discussion on the Western Cascade and High Cascade Subprovinces.) Soils are deep, the elevation is about average for the Cascades, and there are no known operational constraints.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3544.0	589.0
Aspect (deg)	280.9	80.3
Slope (%)	32.6	19.3
Total soil depth (in)	45.2	7.0
Rooting depth (in)	46.9	8.6
Total basal area (ft <sup>2</sup> /ac)	337.5	168.8

**CLIMATE:** Slightly cooler and more moist than the average TSHE association, TSHE-TABR/RHMA is usually high in atmospheric moisture, and thus, low in atmospheric demand. It is a typical highly productive Association, limited by moisture in early to mid summer.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.8	1.3
Maximum month temp(F)	80.3	2.3
Mean annual ppt (in)	61.3	2.5
Dry season ppt (in)	8.3	.5

**FOREST FLOOR:** Forest floor conditions are typical of the Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 24 percent. Lower moss cover (15 percent) in TSHE-TABR/RHMA is within one standard deviation of the Series average.

FOREST FLOOR	MEAN	S.D.
Litter (%)	86.6	18.5
Moss (%)	14.5	20.7
Bareground (%)	1.0	1.8
Gravel (%)	1.5	2.2
Rock (%)	10.9	28.0
Bedrock (%)	.0	.0

**VEGETATION:** A combination of warm, moist species occur in TSHE-TABR/RHMA. Ponderosa pine, Pacific madrone, Douglas-fir, and incense-cedar are more abundant on warmer sites, while western redcedar, red huckleberry and vine maple usually indicate cooler sites. Creambush oceanspray and beargrass indicate the dry extreme. However, beargrass sometimes lacks reliability as an indicator.



**SILVICULTURE:** A variety of species occur in TSHE-TABR/RHMA, providing numerous species mix options. Douglas-fir, western redcedar, western hemlock, incense-cedar, and Pacific yew are all well adapted for survival or growth. The pioneers, Douglas-fir and incense-cedar will tend to dominate in the early stages of succession, but western hemlock and western redcedar will provide significantly more biomass in a mix or alone. Western white pine has pioneering capabilities on the coolest sites of the Association. White fir may be used on most sites but is probably less efficient than the first four conifers mentioned above. Most sites may be a little cool for sugar pine, but on the warmer sites the growth rate will exceed most other conifers. Pacific madrone and golden chinquapin are the most frequently occurring hardwoods. Both will produce well on the drier sites of the Association. Potential for natural regeneration is estimated to be moderately high. Composition can be controlled by the amount of canopy cover left and the amount of soil surface disturbed. Ceanothus also responds well to disturbed soils as opposed to vine maple, which may be competitive, if harvest activities are light. Thinning regimes should take species mix into account by varying density relative to the tolerance of the desired crop tree. Such a strategy will also reduce the need for managing competing vegetation and channeling as much biomass as possible into the designated crop species. Salal may physically impede planting. Although planting is still possible in medium covers of salal, the quality can be reduced to the point of causing regeneration failure. Some means of site preparation should be considered when high covers of salal and rhododendron are present.

**WATERSHED MANAGEMENT:** TSHE-TABR/RHMA has a strong affinity for the lower slope, concave positions. Pacific rhododendron and salal so dominate most sites that herbaceous cover is

sometimes sparse. See the Series description for more complete information.

**FIRE MANAGEMENT:** Twenty five percent of sample sites had evidence of fire, 10 percent lower than the average for the Series. As mentioned in the Series Summary, Pacific yew is an indicator of atmospheric moisture, a deterrent to fuel drying.

**RANGE & WILDLIFE MANAGEMENT:** TSHE-TABR/RHMA supports few forage or browse plants. The Association is dominated by salal and Pacific rhododendron. Vine maple occurs sporadically and red huckleberry occasionally occurs, but total herb cover averages 18 percent and does not usually exceed 35 percent. Salal and rhododendron may occasionally total 200 percent cover. All ages of western hemlock are present in older stands with Pacific yew as an occasional codominant. Both forest floor and vertical structure are diverse. Niches for all types of animals are abundant.

**RECREATION & VISUAL MANAGEMENT:** Recreational and visual attributes are about average for the TSHE Series. Most sites are midslope with no vistas, or unusual visual variety. They are relatively cool, moist and floristically rich. Elevations fall within 2400-4000 feet, slopes average about 33 percent, there usually are two ephemeral streams within each half mile, and the difference in elevation between the stream bottom and the ridgetop is about 600 feet on a 2000 foot long slope. The multilayer tree cover is dense, usually over 100 percent. On the average, site shrub cover totals about 70 percent. Vine maple and Pacific rhododendron provide color, but Pacific rhododendron with salal inhibits access. Red huckleberry provides some edible berries, but the crop usually is sparse. Pacific yew, quite common on most sites, grows an attractive bright red poisonous berry.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	37%	11.7	7.6	warmer, stable, even, protected conditions
CADE3	incense-cedar	50%	12.0	2.4	more abundant on warmer sites
PILA	sugar pine	37%	10.0	8.7	more seral in behavior
PIMO	western white pine	25%	3.0	2.8	cold sites, frost tolerant
PSME	Douglas-fir	100%	38.7	19.4	abundant on warmer sites
TSHE	western hemlock	62%	19.4	9.4	well adapted for survival or growth
	TOTAL OVERSTORY	100%	65.7	24.8	
	—CONIFERS—				
ABCO	white fir	50%	15.2	10.3	may be used but less efficient
CADE3	incense-cedar	62%	15.0	11.7	pioneer species
PILA	sugar pine	12%	1.0	.0	on warmer sites growth rate will exceed most other conifers
PIMO	western white pine	25%	3.5	2.1	pioneering capabilities on the coolest sites
PSME	Douglas-fir	37%	11.7	7.6	
TABR	Pacific yew	100%	7.4	6.3	sites with higher than average atmospheric moisture
THPL	western redcedar	12%	25.0	.0	wetter sites
TSHE	western hemlock	100%	38.1	22.8	moderately warm, wetter
	—HARDWOODS—				
ACCI	vine maple	75%	15.2	8.9	competitive species, sprouter
ACGL	Douglas maple	12%	1.0	.0	indicates moist, rocky sites
ARME	Pacific madrone	12%	2.0	.0	produces well on drier sites
CACH	golden chinquapin	87%	20.4	27.8	produces well on drier sites
	TOTAL UNDERSTORY	100%	100.6	21.3	
AMAL	western serviceberry	12%	1.0	.0	
ARCO3	hairy manzanita	12%	18.0	.0	indicates recent soil disturbance and dry sites
BENE	dwarf Oregongrape	100%	19.4	14.3	moderate climate
CHME	little prince's-pine	25%	1.0	0	
CHUM	common prince's-pine	87%	3.3	2.6	
GAFR	Fremont silk-tassel	12%	2.0	0	
GASH	salal	100%	48.1	22.0	may physically impede planting
HODI	creambush ocean-spray	12%	3.0	0	
PAMY	Oregon boxwood	25%	3.0	2.8	
RHMA	Pacific rhododendron	100%	50.0	28.3	possible vegetation management concern
ROGY	baldhip rose	37%	3.0	1.0	
RUNI	snow bramble	12%	5.0	0	
RUUR	Pacific blackberry	50%	3.0	1.4	
VAPA	red huckleberry	62%	3.4	1.5	edible fruits
WHMO	whipplevine	50%	2.3	1.5	warmer, drier sites
	TOTAL SHRUB	100%	130.9	39.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	25%	1.5	.7	generally on sites with frost and deep snowpack  mid to late successional  nitrogen fixer  invades after disturbance  part of mesic middle indicators early successional mesic sites
ANDE	threelaf anemone	12%	1.0	.0	
ARMA3	bigleaf sandwort	12%	2.0	.0	
ASCA3	western wild ginger	12%	2.0	.0	
ASHA	marbled wild ginger	12%	1.0	.0	
CASC2	rough harebell	12%	1.0	.0	
CLUN	queen's cup	12%	1.0	.0	
COLA	cutleaf goldthread	12%	2.0	.0	
COMA3	spotted coral-root	12%	1.0	.0	
DIHOO	Oregon fairybell	37%	1.0	.0	
GAAP	catchweed bedstraw	12%	1.0	.0	
GOOB	rattlesnake-plantain	62%	1.2	.4	
HECO	gnome-plant	12%	1.0	.0	
HAL	white-flowered hawkweed	37%	1.0	.0	
HYMO	fringed pinesap	12%	1.0	.0	
LAPO	leafy peavine	12%	1.0	.0	
LIBOL	western twinflower	87%	6.9	6.5	
MOUN2	Indian-pipe	25%	1.0	.0	
NEHE	small white nemophila	12%	2.0	.0	
POMU	western sword-fern	62%	2.4	.9	
PTAQ	bracken	12%	2.0	.0	
PTAN	woodland pinedrops	12%	1.0	.0	
PYAS	alpine pyrola	25%	1.5	.7	
PYPI	whitevein pyrola	25%	1.0	.0	
SYRE	snow-queen	25%	1.5	.7	
TRLA2	western starflower	50%	1.5	.6	
TROV	white trillium	50%	1.8	1.0	
VAHE	white inside-out-flr	12%	1.0	.0	
VIGL	stream violet	25%	2.0	.0	
VIOR2	round-leaved violet	25%	1.5	.7	
XETE	common beargrass	37%	6.7	9.8	
	TOTAL HERB	100%	18.2	10.5	
BRPA	Pacific brome	12%	1.0	.0	
FERU	red fescue	12%	1.0	.0	
	TOTAL GRASS	100%	.4	.5	

**WESTERN HEMLOCK - INCENSE-CEDAR / SALAL**  
*Tsuga heterophylla* - *Calocedrus decurrens* / *Gaultheria shallon*  
**TSHE-CADE3/GASH**

**EXTENT:** TSHE-CADE3/GASH is associated with the Western Cascades Subprovince. It occurs on the North Umpqua and Tiller Ranger Districts. N = 9 plots.

**IDENTIFYING**

**CHARACTERIS-**

**TICS:** TSHE-CADE3/GASH differs from other associations with consistent and moderate cover of incense-cedar, and the lack of Western redcedar and western white pine. Low herb cover is also characteristic of the Association. It is unlike most other TSHE associations in the Northwest.

**ABIOTIC ENVIRONMENT:** Parent rock type is basalt or andesite. Soils are deep, slopes are gentle, and there are no operational constraints related to site conditions. Aspects generally are east, but can also be hot, south facing and steep. More information is presented in the discussion on the Western Cascade and High Cascade Subprovinces.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3422.0	195.0
Aspect (deg)	100.4	106.5
Slope (%)	25.2	18.4
Total soil depth (in)	43.0	13.8
Rooting depth (in)	44.88	10.6
Total basal area (ft <sup>2</sup> /ac)	244.4	85.9

**CLIMATE:** TSHE-CADE3/GASH is close to the center of the TSHE environmental grid (see Figure 10). It is slightly drier than the average association as indicated by the complement of plants, and unlike most other associations, it commonly occurs near the ridgetops or upper third slope positions. Annual and dry season precipitation are lower than average. Moisture, soil and atmospheric, are limiting to biomass production. High summer temperatures and winds create a high transpirational demand.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.3	.5
Maximum month temp(F)	80.9	.8
Mean annual ppt (in)	58.6	6.9
Dry season ppt (in)	7.6	1.0

**FOREST FLOOR:** Forest floor litter (needles, leaves, branches and decomposing logs) covers about 98 percent of the forest floor and usually less than 5 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 6 percent. The occurrence of moss in TSHE-CADE3/GASH is comparatively low for the Series.

FOREST FLOOR	MEAN	S.D.
Litter (%)	98.3	2.5
Moss (%)	5.9	6.6
Bareground (%)	.2	.4
Gravel (%)	.3	.7
Rock (%)	3.6	5.1
Bedrock (%)	.6	1.7

**VEGETATION:** Sugar pine is indicative of the better sites in the Association. It often occurs with Pacific madrone, where fire has been part of recent stand history. Whipplevine and baldhip rose decrease with time since disturbance. Whipplevine is associated with drier sites in the Association. Salal and Pacific rhododendron seem to be constants regardless of seral stage. They are common and well adapted to most conditions.

**SILVICULTURE:** Douglas-fir and incense-cedar are the most productive conifers. Western hemlock, western white pine, and white fir, in descending order, are less efficient. Big-leaf maple, Pacific madrone, and golden chinquapin are efficient in early stages of succession. Incense-cedar will survive well on the drier sites although biomass production may be slightly lower than Douglas-fir, if a mixture is not used. Incense-cedar has additional advantages of being resistant to drought, insects, and disease. Western white pine and white fir are most appropriate on the higher, cooler sites. Warm, exposed conditions lower regeneration potential along with the high cover of Pacific rhododendron and salal. Removing shrubs is a two-edged sword. Competition and physical barriers are removed, but the microclimate becomes more extreme, possibly hostile, for seedlings, and nutrient cyclers are lost. Pacific rhododendron, big-leaf maple, and snowbrush are the most intense competitors. Vine maple may be competitive on some sites.

**WATERSHED MANAGEMENT:** Typical of the Series, the shrub layer is dominated by salal and Pacific rhododendron with cover up to 150 percent. However, **TSHE-CADE3/GASH** is usually found on the upper third of the slope, unlike most **TSHE** sites. Douglas-fir and incense-cedar, the dominant trees, are also appropriate for revegetation projects. Both efficiently pioneer hot disturbed sites, and incense-cedar can tolerate a wide range of imbalanced or infertile soils.

**FIRE MANAGEMENT:** Fire occurrence (44 percent of the plots) is slightly higher than the 35 percent average for the Series. Incense-cedar often is associated with fire occurrence as is Douglas-fir, which is known throughout the Pacific Northwest as a disturbance dependent species.

**RANGE & WILDLIFE MANAGEMENT:** Low forage cover (18 percent) and domination by Pacific rhododendron and salal typify most stands. Vine maple and thin-leaved huckleberry are sometimes present, but generally provide little cover. Grasses are rare, but tend to increase immediately after dis-

turbance. However, discouraging the immediate return of salal, rhododendron, and vine maple, will require considerable effort and energy. Like most older **TSHE** stands, structural characteristics are ideal for wildlife.

**RECREATION & VISUAL MANAGEMENT:** Sites are warm for the **TSHE** Series. Elevations fall within 2400-4000 feet, slopes average near 33 percent, there usually are two ephemeral streams within each half mile, and the difference in elevation between the stream bottom and the ridgetop is about 600 feet on a 2000 foot long slope. Tree cover is two or more storied and dense, usually over 100 percent. Incense-cedar gives **TSHE-CADE3/GASH** a characteristic look and feel. There are old, large cedar with wide crowns and distinctive bark that stands out adding visual variety. Often the cedar provide openings from an otherwise dense continuous mass of Pacific rhododendron and salal. Shrub cover averages over 150 percent and occasionally suppresses herb growth. Most sites are midslope with no vistas, nor unusual visual variety.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
CADE3	incense-cedar	55%	14.0	5.5	resistant to drought, insects and disease, most productive indicative of better sites appropriate on higher, cooler sites most productive moderately warm
PILA	sugar pine	66%	11.3	9.1	
PIMO	western white pine	33%	3.7	1.2	
PSME	Douglas-fir	100%	34.4	15.3	
TSHE	western hemlock	44%	9.0	8.0	
	TOTAL OVERSTORY	100%	55.0	9.1	
ABCO	—CONIFERS— white fir	33%	13.3	2.9	appropriate on higher, cooler sites efficiently pioneers hot, disturbed sites  colder sites efficiently pioneers hot, disturbed sites
CADE3	incense-cedar	100%	14.7	12.2	
PILA	sugar pine	33%	2.0	1.0	
PIMO	western white pine	11%	1.0	.0	
PSME	Douglas-fir	88%	19.0	15.4	
TSHE	western hemlock	100%	19.0	9.4	
ACCI	—HARDWOODS— vine maple	44%	9.5	7.6	intense competitor occurs where fire has been part of recent stand history indicates shallow, rocky soils
ACMA	big-leaf maple	11%	15.0	.0	
ARME	Pacific madrone	22%	10.0	.0	
CACH	golden chinquapin	100%	11.8	9.9	
	TOTAL UNDERSTORY	100%	75.7	22.7	
AMAL	western serviceberry	22%	3.5	.7	constant regardless of seral stage  constant regardless of seral stage decrease with time since disturbance        associated with drier sites
BENE	dwarf Oregon grape	88%	15.7	12.6	
CHME	little prince's-pine	11%	1.0	.0	
CHUM	common prince's-pine	44%	2.3	1.0	
GASH	salal	100%	84.2	11.1	
LOHI	hairy honeysuckle	11%	1.0	.0	
RHMA	Pacific rhododendron	100%	55.0	23.3	
ROGY	baldhip rose	55%	2.0	.7	
RUUR	Pacific blackberry	44%	3.0	.8	
SYMO	creeping snowberry	11%	5.0	.0	
VAPA	red huckleberry	44%	5.5	5.2	
WHMO	whipplevine	33%	4.3	1.2	
	TOTAL SHRUB	100%	162.1	27.7	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	22%	3.0	2.8	
ADBI	trail-plant, pathfinder	11%	1.0	.0	
ANDE	threeleaf anemone	11%	1.0	.0	
ARCO	heart-leaf arnica	11%	1.0	.0	
CLUN	queen's cup	11%	2.0	.0	
COLA	cutleaf goldthread	11%	2.0	0	
COST2	hooded coral-root	11%	1.0	.0	
DIHOO	Oregon fairybell	33%	1.0	.0	
EBAU	phantom-orchid	11%	1.0	.0	
FRVEB	woods strawberry	11%	1.0	.0	
GOOB	rattlesnake-plantain	66%	1.0	.0	
HIAL	white-flowered hawkweed	11%	1.0	.0	
IRCH	slender-tubed iris	11%	1.0	.0	
LAP0	leafy peavine	11%	1.0	.0	nitrogen fixer
LIBOL	western twinflower	66%	12.5	18.7	
MAMA	woodland tarweed	22%	1.0	.0	hot, dry sites
MOUN2	Indian-pipe	11%	1.0	.0	
PHAD	woodland phlox	11%	1.0	0	
POMU	western sword-fern	33%	2.7	1.5	more productive sites
PTAQ	bracken	33%	2.3	2.3	
PYAS	alpine pyrola	11%	1.0	0	late successional
PYPI	whitevein pyrola	22%	1.0	0	
PYSE	one-sided pyrola	22%	1.0	0	
SYRE	snow-queen	33%	2.0	1.0	
TRLA2	western starflower	66%	1.5	.8	
TROV	white trillium	44%	1.0	.0	moist sites
VIAM	American vetch	11%	1.0	0	
VIAD	early blue violet	11%	1.0	.0	
VIGL	stream violet	11%	1.0	.0	early successional
VIOR2	round-leaved violet	11%	1.0	0	mesic sites
XETE	common beargrass	44%	3.3	3.3	
	TOTAL HERB	100%	18.2	20.1	
FE0C	western fescue	22%	1.0	.0	
LUCA2	tailcup lupine	11%	1.0	0	
	TOTAL GRASS	100%	3	.5	

**WESTERN HEMLOCK / SALAL / WESTERN TWINFLOWER**  
*Tsuga heterophylla* / *Gaultheria shallon* / *Linnaea borealis longiflora*  
**TSHE/GASH/LIBOL**

**EXTENT:** TSHE/GASH/LIBOL occurs on the North Umpqua and Tiller Ranger Districts of the Umpqua National Forest. It rarely occurs on Cottage Grove and Diamond Lake Ranger Districts. It is most commonly associated with the Umpqua Basin and Western Cascades Subprovinces. N = 19 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/GASH/LIBOL supports high cover of western redcedar, but not white fir. Salal and Pacific rhododendron are abundant. A typical TSHE association, it is most similar to TSHE/GASH on the Willamette and Siuslaw National Forests (Hemstrom et al. 1987) (Hemstrom and Logan 1986).

**ABIOTIC ENVIRONMENT:** Parent rock type is basalt, except for the occasional occurrence of metamorphosed igneous rock. Elevation averages about 1,000 ft. lower than the average Cascade site, but slopes are essentially average for the Cascade Province. Aspects vary about east and range from slightly northwest to south. More information is presented in the discussion on the Western Cascade and High Cascade Subprovinces.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2845.0	621.0
Aspect (deg)	63.8	90.2
Slope (%)	31.4	17.3
Total soil depth (in)	43.3	13.5
Rooting depth (in)	48.3	6.9
Total basal area (ft <sup>2</sup> /ac)	285.3	72.1

**CLIMATE:** TSHE/GASH/LIBOL is warmer and more moist than the average association, but lethal stress can develop during dry summers. There is wide variation within associations; the use of corresponding indicators will help to resolve site specific conditions.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.7	1.7
Maximum month temp(F)	83.1	2.5
Mean annual ppt (in)	63.5	4.7
Dry season ppt (in)	8.8	0.7

**FOREST FLOOR:** Forest floor conditions are similar to the Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 23 percent. TSHE/GASH/LIBOL supports more moss than the average Cascade site and less rock and gravel. The warm, wet climate will stimulate decomposition of high litter input of intolerant species that dominate the site. Frequent, low intensity fire also consumes coarse organic material. High decomposition rates are dependent on a healthy soil ecosystem.

FOREST FLOOR	MEAN	S.D.
Litter (%)	84.5	20.0
Moss (%)	33.7	25.7
Bareground (%)	.2	.5
Gravel (%)	.4	1.2
Rock (%)	.9	1.6
Bedrock (%)	.5	2.3

**VEGETATION:** A typical TSHE association with high cover of salal and Pacific rhododendron, dominant to Douglas-fir and western hemlock, the climate is moderate to slightly drier than the average association. Douglas-fir and incense-cedar are the early successional species; Pacific yew, western redcedar, and western hemlock are best adapted to thrive in late successional conditions. Sugar pine, often present, tends to be best adapted to early successional stages, but can tolerate the shade of the average canopy and reproduces and survives well although growth rates are reduced by shade.



**SILVICULTURE:** Potential for natural regeneration is medium to low. Total reliance on naturals after clear-cutting and intense site preparation would have a high risk of failure. Site specific variation is high, nine species of conifers and three hardwood species commonly occur on various TSHE/GASH/LIBOL sites. Overall, western hemlock, incense-cedar, and western redcedar are most efficient, followed by Douglas-fir, sugar pine, white fir, red alder, Pacific yew, western white pine, golden chinquapin, ponderosa pine, and Pacific madrone. Douglas-fir, incense-cedar, sugar pine, ponderosa pine, western white pine, and madrone are well adapted to open, severely disturbed sites. Managing competing alder, Pacific rhododendron, and snowbrush may be necessary to attain planned yield.

**WATERSHED MANAGEMENT:** Typical of the Series, found on the lower slope positions and dominated by salal and Pacific rhododendron, the Series description provides an accurate view of watershed characteristics.

**FIRE MANAGEMENT:** Salal dominates the driest sites of the Series, which tend to have a higher than average fire occurrence. TSHE/GASH/LIBOL had 8 of 19 plots burned (42 percent). The mix of species

is typical of the Series: a combination of both dry and moist indicators.

**RANGE & WILDLIFE MANAGEMENT:** Forage availability is average for the Series, but varies from 1 to 100 percent cover. As in many associations in the TSHE Series, availability of browse is low. Although trailing blackberry, California hazel, and dogwood occur, cover is usually low. Most stands are dominated by Pacific rhododendron and salal. Structural variety is high, hiding and thermal cover for big game is abundant, and the forest floor supports a variety of sizes and forms of organic material.

**RECREATION & VISUAL MANAGEMENT:** Sites are cool, moist and floristically rich. Tree cover is two or more storied and dense, usually over 100 percent. Western redcedar is common and lends additional character to the site. It tends to shade Pacific rhododendron and salal, but leaves enough light to host a rich herb layer. Vine maple provides fall color, particularly in disturbed sites (sometimes known as clearcuts), and trailing blackberry and red huckleberry provide some edible fruit. Pacific dogwood is often present and showy in the spring. Most other site characteristics are average for the Series.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
CADE3	incense-cedar	15%	4.0	1.7	early successional species, adapted to open, disturbed sites
PILA	sugar pine	26%	11.8	9.3	can tolerate shade of the average canopy
PIMO	western white pine	15%	8.3	5.8	adapted to open and severely disturbed sites
PSME	Douglas-fir	100%	40.0	15.2	early successional, adapted to open, disturbed sites
THPL	western redcedar	52%	10.7	6.4	thrives in late successional conditions, co-climax
TSHE	western hemlock	68%	28.7	24.3	climax
	TOTAL OVERSTORY	100%	70.3	19.4	
	—CONIFERS—				
ABCO	white fir	36%	14.7	10.4	
CADE3	incense-cedar	15%	11.0	12.2	warmer, drier sites
TABR	Pacific yew	68%	11.9	7.8	late successional, co-climax
THPL	western redcedar	89%	12.9	8.6	lends additional character to the stand
TSHE	western hemlock	100%	48.4	27.6	
	—HARDWOODS—				
ACCI	vine maple	68%	22.7	21.8	provides fall color
ALRU	red alder	5%	5.0	.0	competes, may have to manage
ARME	Pacific madrone	10%	7.5	.7	intermediate sites with recent disturbance
CACH	golden chinquapin	42%	8.3	9.3	indicates shallow soils
	TOTAL UNDERSTORY	100%	95.4	44.4	
AMAL	western serviceberry	5%	1.0	.0	
BENE	dwarf Oregongrape	100%	16.2	9.1	
CHME	little prince's-pine	36%	1.0	.0	
CHUM	common prince's-pine	63%	2.8	1.9	
CONU	Pacific dogwood	36%	6.7	5.0	showy in the spring
COCOC	California hazel	15%	3.7	1.5	occurs at low elevations on warm sites in well drained soils
GAOV	slender salal	10%	6.5	4.9	
GASH	salal	94%	20.7	21.8	generally dominates shrub layer
HODI	creambush ocean-spray	5%	4.0	.0	often rocky, shallow soils
LOCI	trumpet honeysuckle	5%	1.0	.0	
LOHI	hairy honeysuckle	10%	1.5	.7	hot, dry, open slopes and forests
PAMY	Oregon boxwood	10%	4.5	4.9	
RHPU	cascara	5%	1.0	.0	moist to wet site indicator
RHMA	Pacific rhododendron	78%	48.7	36.2	generally dominates shrub layer
RISA	red currant	5%	1.0	.0	
ROGY	baldhip rose	47%	2.1	1.1	
RULA	dwarf bramble	5%	1.0	.0	cool to cold, moist sites
RUNI	snow bramble	47%	3.4	2.8	cool, moist forests
RUPA	thimbleberry	5%	1.0	.0	
RUUR	Pacific blackberry	73%	2.1	1.3	
SYMO	creeping snowberry	10%	1.5	.7	warm, dry slopes
VAME	thin-leaved huckleberry	26%	1.4	.5	
VAPA	red huckleberry	73%	4.7	5.1	edible fruits
WHMO	whipplevine	42%	2.8	1.5	warm, dry sites at lower elevations
	TOTAL SHRUB	100%	90.6	46.7	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	47%	1.7	1.3	
ADBI	trail-plant, pathfinder	26%	1.0	0	moist sites
ALVI	candystick	5%	1.0	.0	
ANDE	threeleaf anemone	36%	1.0	.0	wet, cool sites
ANLY2	Lyall anemone	5%	1.0	0	
CABU2	fairy-slipper	10%	1.0	.0	
CASC2	rough harebell	5%	1.0	.0	
CLUN	queen's cup	42%	2.3	2.4	well drained soils
COLA	cutleaf goldthread	42%	4.0	4.6	
COMA3	spotted coral-root	21%	1.0	.0	
COME	Pacific coral-root	10%	1.0	.0	
COCA	bunchberry	5%	3.0	.0	
DIHOO	Oregon fairybell	57%	1.1	.3	
GATR	fragrant bedstraw	10%	1.0	.0	
GOOB	rattlesnake-plantain	89%	1.3	.6	found everywhere
HAUN	Alaska bog-orchid	5%	1.0	.0	
HECO	gnome-plant	10%	1.0	.0	
HAL	white-flowered hawkweed	42%	1.0	0	
LICO4	tiger lily	10%	1.0	.0	
LIWA	Washington lily	5%	1.0	0	
LIBOL	western twinflower	89%	25.1	24.2	moist, cool environments
MOUN2	Indian-pipe	5%	1.0	0	
NEHE	small white nemophila	5%	1.0	.0	
PHAD	woodland phlox	5%	1.0	.0	
POMU	western sword-fern	57%	3.3	2.8	on more productive sites
PTAQ	bracken	31%	1.2	.4	can be a disturbance species
PTAN	woodland pinedrops	10%	1.0	0	
PYAP	leafless pyrola	5%	1.0	.0	
PYAS	alpine pyrola	10%	1.0	.0	
PYPI	whitevein pyrola	26%	1.2	.4	
PYSE	one-sided pyrola	5%	1.0	0	
SMRA	western false Solomon's-seal	10%	1.0	.0	
SMST	starry Solomon-plume	5%	1.0	0	generally cool sites
STRO	rosy twisted-stalk	5%	1.0	.0	
SYRE	snow-queen	31%	1.3	.5	
THMO	mountain thermopsis	5%	2.0	0	
TITR	foamflower	15%	1.3	.6	
TRLA2	western starflower	31%	1.2	.4	mid-successional
TROV	white trillium	73%	1.1	.3	
VAHE	white inside-out-fir	10%	1.0	0	warm, moist sites
VIGL	stream violet	15%	2.0	.0	early successional
VIOR2	round-leaved violet	15%	1.7	.6	mesic sites
WISE	redwoods violet	21%	2.3	1.9	
XETE	common beargrass	26%	6.4	5.9	cold, moist to dry
	TOTAL HERB	100%	37.9	26.3	
CAREX	sedge spp.	5%	1.0	0	
FEEL	meadow fescue	5%	1.0	.0	
FEOC	western fescue	15%	1.0	0	
FESU2	bearded fescue	5%	1.0	.0	
	TOTAL GRASS	100%	.4	.6	

**WESTERN HEMLOCK - DOUGLAS-FIR / SALAL**  
*Tsuga heterophylla* - *Pseudotsuga menziesii* / *Gaultheria shallon*  
**TSHE-PSME/GASH**

**EXTENT:** TSHE-PSME/GASH occurs on the North Umpqua and Tiller Ranger Districts. It is not likely to be found in the High Cascade Subprovince. N = 12 plots.

**IDENTIFYING CHARACTERISTICS:** The most abundant tree species are western hemlock, Douglas-fir, and western redcedar. Dwarf Oregon-grape, vine maple, and salal are consistently abundant shrubs, but thin-leaved huckleberry is absent. TSHE-PSME/GASH occurs on warm, dry sites. Its similar to the drier TSHE/GASH sites of the Willamette National Forest.

**ABIOTIC ENVIRONMENT:** Parent rock type is typical basalt/andesite of the western Cascades. Only rarely is TSHE-PSME/GASH found on other parent rock types. Basalt and andesite are the most common parent rock, followed by pumice and ash. All gradations between andesite and basalt, and ash and pumice may be present. In the former, composition shifts from acidic toward basic, in the latter, the difference is mainly size class. Pumice produces coarse textured infertile soils. More information is presented in the discussion on the Western Cascade and High Cascade Subprovinces. Elevation is low, slopes often are steep and south facing, and are warm and dry. Yet, summer rainfall and deep soils with a high moisture holding capacity, help to counter evaporational demand. There are no known operational constraints related to terrain.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2447.0	654.0
Aspect (deg)	280.3	133.2
Slope (%)	40.0	25.0
Total soil depth (in)	44.2	9.88
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	246.7	96.6

**CLIMATE:** Near the warm, moist end of the environmental grid, TSHE-PSME/GASH sites have high annual and maximum temperatures with relatively high annual rainfall. However, dry season precipitation is about equal to the Series average. Since growing season precipitation is critical, the site sup-

ports more dry site indicators and moisture stress most limits biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	48.8	1.7
Maximum month temp(F)	84.7	2.6
Mean annual ppt (in)	63.6	3.8
Dry season ppt (in)	8.3	1.0

**FOREST FLOOR:** Forest floor conditions are similar to the Cascade Province and Western Hemlock Series averages, except the amount of litter (needles, leaves, branches and decomposing logs) and moss is about 20 percent lower than the average Cascade site. Usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. High moss covers are associated with warm temperatures. Decomposition rates are high when temperatures are warm and water is available. Decomposition, along with frequent, low intensity fire, may be responsible for lower amounts of litter found on most sites.

FOREST FLOOR	MEAN	S.D.
Litter (%)	70.7	34.7
Moss (%)	44.8	29.6
Bareground (%)	.9	1.5
Gravel (%)	1.8	1.7
Rock (%)	6.1	9.8
Bedrock (%)	2.1	5.8

**VEGETATION:** Douglas-fir behaves as an early seral invader, but will continue to seed in, even under dense canopies. It is co-climax with western hemlock, and an excellent producer on any site within the association. Western hemlock usually is dominant in the understory, but its presence in the overstory has more meaning, i.e., lack of disturbance and wetter sites of the Series. When western redcedar co-occurs, it indicates the best hemlock producing sites of the Association. The presence of white fir, overstory or understory, indicates the more extreme sites: clear days and nights and the related

temperature extremes; and high moisture demands.

**SILVICULTURE:** Douglas-fir, western hemlock, and western redcedar are the most common and productive conifers on most sites. Sugar pine, white fir, incense-cedar, and ponderosa pine grow well and complement the species mix in appropriate microsites. Pacific yew is common in areas with low evaporative demand, and knobcone pine, a serotinous pine indicating fire within the last 90 years, are specialists. Yew provides excellent hiding and thermal cover, and structural variety. Knobcone can pioneer intensely disturbed sites, attain commercial diameters in a short time (if stocking level is controlled) and provide an intermediate crop. Sites with madrone will continue to have madrone proportional to the pre-management cover and the intensity of the management activity. The potential for natural regeneration is low. Relying solely on naturals for reforestation is risky without providing the overstory cover necessary for dampening environmental extremes. Controlling competing shrubs may be necessary to attain planned crop tree growth. Stocking level control may also be economical as warmer, drier sites tend to stagnate.

**WATERSHED MANAGEMENT:** **TSHE-PSME/GASH** is a typical **TSHE** series association. It is one of the drier associations, but still has ample protec-

tive cover from all layers of vegetation. Being slightly drier than the average **TSHE** association, revegetation of disturbed sites may require special energy and attention to site specific detail.

**FIRE MANAGEMENT:** According to plant indications **TSHE-PSME/GASH** should have one of the highest fire occurrence rates of the Series. Indeed, 50 percent of the plots sampled had evidence of fire. **TSHE-PSME/GASH** maximum and average annual temperatures are higher than average, and it tends to occur on southerly aspects more than any other association in the Series.

**RANGE & WILDLIFE MANAGEMENT:**

Forage cover is below the Series average (24 percent) and can be as low as 9 percent. Typical of the **TSHE** Series, salal and Pacific rhododendron are dominate the shrub layer, with *Rubus* species, thin-leaved huckleberry, and dogwood as potential browse. Diversity in stand and forest floor structure is high. Golden chinquapin and western redcedar can be found in microsites. Redcedar is common in drainages and wetter sites while chinquapin inhabits the drier, rockier sites.

**RECREATION & VISUAL MANAGEMENT:** Generally sites have no unusual visual or recreational characteristics and reflect the average series conditions.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	8%	5.0	.0	indicates more extreme sites
CADE3	incense-cedar	8%	5.0	.0	complements species mix in appropriate microsite
PILA	sugar pine	25%	10.0	8.7	grows well and complements species mix
PSME	Douglas-fir	100%	38.7	18.2	seeds in, even under dense canopies, co-climax
THPL	western redcedar	25%	6.7	2.9	if co-occurs, indicates best hemlock producing sites
TSHE	western hemlock	41%	13.4	6.5	presence in overstory indicates lack of disturbance and wetter sites
	TOTAL OVERSTORY	100%	49.3	22.5	
	—CONIFERS—				
ABCO	white fir	33%	12.0	18.7	warmer sites
CADE3	incense-cedar	33%	3.0	1.6	warmer, drier sites
PILA	sugar pine	33%	1.3	.5	
PSME	Douglas-fir	100%	21.3	16.7	early seral invader
TABR	Pacific yew	41%	9.4	5.9	provides excellent thermal cover
THPL	western redcedar	100%	11.7	7.9	wetter sites
TSHE	western hemlock	100%	49.4	25.2	
	—HARDWOODS—				
ACCI	vine maple	83%	14.6	12.5	
ARME	Pacific madrone	25%	3.7	1.2	will remain in stand proportional to pre-management cover
CACH	golden chinquapin	58%	8.0	7.0	inhabits drier, rockier sites
	TOTAL UNDERSTORY	100%	109.6	28.9	
BENE	dwarf Oregongrape	100%	14.2	15.1	indicates better sites
CHME	little prince's-pine	33%	1.0	.0	
CHUM	common prince's-pine	66%	1.9	.8	
CONU	Pacific dogwood	33%	15.5	11.0	potential browse
COCOC	California hazel	25%	5.3	4.5	
GAOV	slender salal	8%	1.0	.0	cool, moist areas
GASH	salal	91%	33.8	31.4	dominates shrub layer
LOCI	trumpet honeysuckle	8%	1.0	.0	
RHPU	cascara	8%	1.0	.0	moist to wet sites
RHMA	Pacific rhododendron	75%	29.1	17.6	
RHDI	poison oak	8%	2.0	.0	indicates dry, hot sites
ROGY	baldhip rose	41%	2.4	1.7	fruit high in vitamin C
RUNI	snow bramble	25%	7.0	7.2	
RUPA	thimbleberry	8%	3.0	.0	potential browse
RUSP	salmonberry	8%	1.0	.0	potential browse
RUUR	Pacific blackberry	66%	2.8	4.2	potential browse
SYMO	creeping snowberry	16%	1.0	.0	
VAME	thin-leaved huckleberry	8%	3.0	.0	potential browse
VAPA	red huckleberry	75%	5.9	7.6	
WHMO	whipplevine	50%	2.2	2.9	warmer, drier sites
	TOTAL SHRUB	100%	86.5	41.7	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	41%	1.0	.0	common
ADBI	trail-plant, pathfinder	25%	1.0	.0	
ANMA	common pearly-everlasting	8%	1.0	.0	
ANDE	threeleaf anemone	33%	1.3	.5	mesic sites
APAN	spreading dogbane	8%	1.0	0	dry sites
ARMA3	bigleaf sandwort	8%	1.0	.0	
ASHA	marbled wild ginger	16%	1.0	0	
CLUN	queen's cup	8%	1.0	.0	
COLA	cutleaf goldthread	58%	1.9	1.1	
COME	Pacific coral-root	25%	1.0	.0	
COCA	bunchberry	8%	2.0	.0	indicates cool, mesic sites
DIHOO	Oregon fairybell	50%	1.2	.4	
EPAN	fireweed	8%	2.0	.0	disturbance species
EQUIS		8%	1.0	.0	moist to wet sites
FRVEB	woods strawberry	8%	1.0	.0	
GAAP	catchweed bedstraw	25%	1.0	.0	
GOOB	rattlesnake-plantain	75%	1.2	.4	
HECO	gnome-plant	8%	1.0	.0	
HIAL	white-flowered hawkweed	41%	1.2	.4	
IRCH	slender-tubed iris	8%	1.0	.0	
LIBOL	western twinflower	91%	7.2	6.0	
MAMA	woodland tarweed	8%	1.0	.0	
OSCH	mountain sweet-root	8%	1.0	.0	
PEFR2	sweet coltsfoot	8%	1.0	0	
PICA	pine-foot	8%	1.0	.0	
POGL4	licorice-fern	8%	1.0	.0	
POMU	western sword-fern	66%	9.8	20.3	
PTAQ	bracken	58%	2.3	1.9	
PYAS	alpine pyrola	16%	1.5	.7	
PYPI	whitevein pyrola	16%	1.5	.7	
SMST	starry Solomon-plume	8%	1.0	.0	
SYRE	snow-queen	41%	1.4	.5	
TITR	foamflower	8%	1.0	.0	
TRLA2	western starflower	66%	1.6	1.4	
TROV	white trillium	58%	1.0	0	moist sites
VAHE	white inside-out-flr	16%	1.0	0	
VIGL	stream violet	8%	2.0	.0	
VIOR2	round-leaved violet	58%	1.1	.4	
XETE	common beargrass	8%	1.0	.0	colder sites
	TOTAL HERB	100%	24.7	15.1	
BRVU	Columbia brome	8%	1.0	.0	
CAREX	sedge spp.	8%	1.0	.0	
FEOC	western fescue	33%	1.0	0	
FESU	bearded fescue	8%	1.0	.0	
	TOTAL GRASS	100%	8	8	

**WESTERN HEMLOCK / SALAL / COMMON PRINCE'S-PINE**  
*Tsuga heterophylla* / *Gaultheria shallon* / *Chimaphila umbellata*  
**TSHE/GASH-CHUM**

**EXTENT:** TSHE/GASH-CHUM occurs on Tiller and rarely on the North Umpqua and Diamond Lake Ranger Districts. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/GASH-CHUM is typical of the Series, and difficult to distinguish from other Associations dominated by salal and vine maple. Pacific rhododendron occurs on most sites with moderate cover. Pacific dogwood, and California hazel are often present. The presence of golden chinquapin with both western hemlock and white fir is somewhat unusual. TSHE/GASH-CHUM is similar to climatically moderate TSHE/GASH associations of the Willamette National Forest (Hemstrom et al. 1987).

**ABIOTIC ENVIRONMENT:** Parent rock usually is rhyolite or granite, fine grained and coarse grained, respectively, acid igneous rocks. Usually nutritionally poor with a low water holding capacity, they affect vegetation composition and slow the rates of many ecosystem processes. Soils are significantly shallower than either the Series or Cascade averages. On the average, aspect is south and elevations are low. Thus, the climate is warmer and drier than most other Associations.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2819.0	679.0
Aspect (deg)	181.7	80.8
Slope (%)	34.7	24.3
Total soil depth (in)	34.6	15.2
Rooting depth (in)	39.3	14.1
Total basal area (ft <sup>2</sup> /ac)	295.0	129.9

**CLIMATE:** One of the warmest and driest Associations in the Series, both average annual and monthly maximum temperatures are high. Moreover, annual average and dry season rainfall are lower than all other associations, except for TSHE/GASH/HIAL. High temperature directly and indirectly affects growth and survival. Soil surface temperatures on south slopes can exceed 140 degrees F., which can be lethal to small seedlings. The indirect effects are increased evapotranspirational demand.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	48.0	1.8
Maximum month temp(F)	83.3	2.8
Mean annual ppt (in)	54.4	9.0
Dry season ppt (in)	7.5	1.2

**FOREST FLOOR:** Forest floor conditions are not significantly different from the average Cascade Province and Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor. However, litter cover is slightly higher than average and the higher cover of moss reflects the warmer temperatures characteristic of TSHE/GASH-CHUM.

FOREST FLOOR	MEAN	S.D.
Litter (%)	98.7	2.3
Moss (%)	38.4	30.6
Bareground (%)	.8	1.2
Gravel (%)	.8	1.8
Rock (%)	.4	.7
Bedrock (%)	3.8	10.6

**VEGETATION:** The typical Cascade complement of vegetation occurs on most sites. Warmer sites support incense-cedar and canyon live oak. An occasional oak can simply indicate a dry rocky microsite, but as cover increases the potential for growth and survival decreases. Creambush oceanspray correspondingly indicates dry, shallow soils. Mesic sites are indicated by Pacific yew, Pacific dogwood, and the presence of western hemlock in the overstory.

**SILVICULTURE:** Douglas-fir and western hemlock are the most productive conifers. They often occur at opposite ends of the successional scale, but would be a productive mix even in early successional stands. Incense-cedar and Pacific yew, also very common on most sites, seem to be found in pioneer and late seral stages respectively. Both are thought of as low producers, however, incense-cedar grows well in the open. Yew, on the other hand, deserves its reputation. Less common are ponderosa pine,



big-leaf maple, Pacific madrone, golden chinquapin, white fir, knobcone pine and canyon live oak. Hardwoods sprout and will be part of any new stand and all conifers may be used in microsites to add diversity in composition and structure. Salal will be a barrier to artificial planting and provide competition as will the hardwoods mentioned above. The potential for natural regeneration is low. Overstocked stands may be economically thinned.

**WATERSHED MANAGEMENT:** Although most sites have shallow soils, they tend to be in concavities that collect water. Yet, evaporative demand is likely to be higher than the average association. The overall effects on water yield are likely to be negative.

**FIRE MANAGEMENT:** TSHE/GASH-CHUM is typical of the TSHE Series, with a mix of indicators, including high cover of salal. The percent of plots with evidence of having been burned is 38, slightly higher than the average for the Series.

**RANGE & WILDLIFE MANAGEMENT:** Potential for domestic range use is low. Sites are steep, forested, and lack both forage and browse. In forested condition, forage cover averages about 22 percent (40

percent is often maximum cover) with very little grass. Little is known about preference and current utilization by wildlife. Blackberry species, red huckleberry, Pacific dogwood, California hazel, and creambush oceanspray are sometimes used as browse for wildlife. Domestic stock may also use them if grasses are not available. Disturbed sites are more apt to produce grasses, but may require control of native species or intense disturbance of the soil surface. Stand structural properties are diverse. Soils are somewhat shallow and dry quickly during normal years. Some sensitive varieties of slender-tubed iris may be present.

**RECREATION & VISUAL MANAGEMENT:**

Recreational and visual conditions are similar to the Series, but most sites are drier. Thus, revegetation, regulation of traffic, and development may require more care in species selection, handling, and maintenance. The resilience of drier sites generally is low. Tree cover is two or more storied and dense, usually over 100 percent. Shrub cover averages 97 percent, but can exceed 200 percent, an indication that foot travel can be slow and difficult, particularly uphill. Most sites are midslope with no vistas, nor unusual visual variety.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	37%	10.0	.0	warmer, stable, even, protected sites on warmer sites most productive indicates mesic sites, most productive
CADE3	incense-cedar	37%	10.0	5.0	
PSME	Douglas-fir	100%	49.4	17.2	
TSHE	western hemlock	50%	17.5	10.4	
	TOTAL OVERSTORY	100%	65.6	7.8	
ABCO	—CONIFERS— white fir	87%	12.6	10.1	pioneer stages, grows well in the open  indicates mesic sites, late seral stages moderately warm, wetter
CADE3	incense-cedar	37%	14.0	10.1	
PSME	Douglas-fir	50%	6.5	4.4	
TABR	Pacific yew	50%	18.7	6.3	
TSHE	western hemlock	100%	26.2	13.0	
	—HARDWOODS— vine maple	75%	42.5	26.4	red fall colors indicates moist, rocky sites will compete with conifers pioneer species, fire established  on warmer sites
ACGL	Douglas maple	12%	1.0	.0	
ACMA	big-leaf maple	25%	10.0	7.1	
ARME	Pacific madrone	25%	11.0	8.5	
CACH	golden chinquapin	100%	8.9	7.9	
QUCH	canyon live oak	12%	7.0	.0	
	TOTAL UNDERSTORY	100%	102.1	32.7	
AMAL	western serviceberry	12%	2.0	.0	
BENE	dwarf Oregongrape	100%	22.0	21.3	
BEPI	Piper's Oregongrape	25%	1.5	.7	
CHME	little prince's-pine	12%	1.0	.0	drier, rockier, less productive sites than where BENE occurs  indicates mesic sites possible browse species
CHUM	common prince's-pine	100%	5.8	10.1	
CONU	Pacific dogwood	62%	2.2	1.3	
COCOC	California hazel	75%	3.5	1.5	
GASH	salal	100%	50.9	29.7	
HODI	creambush ocean-spray	37%	4.7	6.4	indicates dry, shallow soils  moist, cool sites  moist to wet site indicator
LOCI	trumpet honeysuckle	12%	1.0	.0	
PAMY	Oregon boxwood	37%	6.0	7.8	
PHCA3	Pacific ninebark	12%	1.0	0	
RHPU	cascara	25%	1.5	.7	
RHMA	Pacific rhododendron	25%	6.5	2.1	
RIBES	currant spp.	12%	1.0	.0	
ROGY	baldhip rose	62%	1.6	.9	
RUPA	thimbleberry	12%	3.0	.0	
RUUR	Pacific blackberry	75%	1.8	1.0	
SYMO	creeping snowberry	50%	1.5	6	not on cold, frosty sites warmer, drier sites
VAPA	red huckleberry	62%	3.0	1.2	
WHMO	whipplevine	62%	3.6	3.0	
	TOTAL SHRUB	100%	97.4	51.0	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	62%	3.8	2.6	<p>well-drained soils</p> <p>generally warm sites</p> <p>annual</p> <p>perennial</p> <p>some sensitive varieties may be present</p> <p>moist forest sites</p> <p>mid successional</p> <p>moist sites</p> <p>lower elevations, warm, moist sites</p> <p>mesic sites</p>
ADBI	trail-plant, pathfinder	50%	1.0	.0	
ANDE	threeleaf anemone	25%	1.5	.7	
ASCA3	western wild ginger	12%	1.0	0	
ASHA	marbled wild ginger	37%	1.3	6	
CASC2	rough harebell	25%	1.0	.0	
CLUN	queen's cup	12%	1.0	0	
COLA	cutleaf goldthread	25%	2.5	.7	
COMA3	spotted coral-root	12%	1.0	.0	
COST2	hooded coral-root	25%	1.0	.0	
DIHOO	Oregon fairybell	37%	1.0	.0	
FRVEB	woods strawberry	12%	1.0	.0	
GAAP	catchweed bedstraw	25%	1.0	.0	
GATR	fragrant bedstraw	12%	1.0	.0	
GOOB	rattlesnake-plantain	87%	1.0	.0	
HAL	white-flowered hawkweed	37%	1.0	.0	
HYMO	fringed pinesap	12%	1.0	.0	
IRIS	iris spp.	12%	1.0	.0	
IRCH	slender-tubed iris	12%	1.0	.0	
LIBOL	western twinflower	87%	4.9	4.7	
PENST		12%	1.0	.0	
POMU	western sword-fern	62%	4.0	1.0	
PTAQ	bracken	25%	1.5	.7	
PTAN	woodland pinedrops	25%	1.0	.0	
PYPI	whitevein pyrola	12%	1.0	.0	
PYSE	one-sided pyrola	12%	1.0	.0	
SEBO	Bolander's groundsel	12%	1.0	.0	
SYRE	snow-queen	25%	1.0	.0	
TITR	foamflower	25%	1.0	.0	
TRLA2	western starflower	100%	2.4	2.0	
TROV	white trillium	75%	1.0	0	
VAHE	white inside-out-flr	50%	1.3	5	
VIAD	early blue violet	12%	2.0	0	
VIGL	stream violet	12%	1.0	0	
VIOR2	round-leaved violet	37%	1.3	6	
XETE	common beargrass	25%	5.5	6.4	
	TOTAL HERB	100%	22.1	10.7	
BRPA	Pacific brome	25%	1.0	.0	
CAREX	sedge spp.	12%	1.0	.0	
FESTU	fescue spp.	12%	1.0	.0	
FEOC	western fescue	25%	1.0	.0	
FESU	bearded fescue	12%	1.0	.0	
	TOTAL GRASS	100%	9	1.0	

**WESTERN HEMLOCK / SALAL / WHITE-FLOWERED HAWKWEED**  
*Tsuga heterophylla* / *Gaultheria shallon* / *Hieracium albiflorum*  
**TSHE/GASH/HIAL**

**EXTENT:** TSHE/GASH/HIAL occurs mostly on Tiller and rarely on the North Umpqua Ranger District. It is associated with the Western Cascade and Klamath Subprovinces. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/GASH/HIAL is the warmest, driest Association of the Series. The abundance of incense-cedar, Douglas-fir (both overstory and understory), sugar pine, and white fir are testament. Additionally, poison oak, hairy honeysuckle, and whipplevine occasionally occur at the driest extremes. The Association is considerably drier than other TSHE/GASH associations in the northwest.

**ABIOTIC ENVIRONMENT:** Parent rock type is pumice, ash or occasionally dacite, all acidic, generally sterile substrates. However, soils are deep and seem productive; salal cover is high. Elevation is low and aspects are south, typical of warm, dry associations of the Series. Slopes can be over 60 percent and very subject to erosion after disturbance.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2716.0	463.0
Aspect (deg)	174.9	88.8
Slope (%)	39.3	17.9
Total soil depth (in)	44.7	9.0
Rooting depth (in)	47.0	5.2
Total basal area (ft <sup>2</sup> /ac)	254.3	74.6

**CLIMATE:** TSHE/GASH/HIAL is the warmest, driest Association in the Series. Temperatures are high and rainfall is low. Moreover, it tends to occur on south facing upper slope positions. Humidity is low, and average wind speed is likely to be high. The interaction of moisture and temperature most limits biomass production. Moisture stress occurs early in the summer.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	48.2	1.2
Maximum month temp(F)	83.7	1.7
Mean annual ppt (in)	51.7	5.2
Dry season ppt (in)	7.2	.4

**FOREST FLOOR:** Forest floor conditions are rockier than the average site in the Series. Bedrock and gravel (5 percent) is five times higher than the average TSHE site. Loose rock is about double the average. Other variables are similar to average Cascade and Western Hemlock conditions.

FOREST FLOOR	MEAN	S D.
Litter (%)	88.3	17.1
Moss (%)	18.1	18.8
Bareground (%)	2.6	1.9
Gravel (%)	5.0	3.7
Rock (%)	9.4	18.0
Bedrock (%)	5.7	15.1

**VEGETATION:** The cover of incense-cedar, sugar pine, Douglas-fir, creambush oceanspray, whipplevine, snowberry, and the presence of poison oak indicate the relative dryness of TSHE/GASH/HIAL. It is the warmest, driest Association in the Series. Douglas-fir and incense-cedar, both common in the understory, are well adapted to early seral stages, but either will regenerate and survive well under the average TSHE canopy. Western redcedar and white fir will regenerate significantly better during the late seral stages.

**SILVICULTURE:** Douglas-fir and western hemlock are the most productive conifers. Sugar pine is highly productive on the more moist sites. Incense-cedar and ponderosa pine, also very common on most sites, are found as pioneers and are well adapted. Pacific yew, white fir and knobcone pine are less common but may be appropriate in specialized microsites. Big-leaf maple, Pacific madrone, and golden chinquapin sprout and will be part of any new stand. Salal will be a barrier to artificial planting and provide competition as will the hard-

woods mentioned above. The potential for natural regeneration is the lowest for the Series. Overstocked stands may need thinning to achieve planned growth rates.

**WATERSHED MANAGEMENT:** Rainfall is low and evapotranspiration is high. Overall water yield is lower than the average **TSHE** association. Unlike most associations, it often occurs on the upper third of a south facing slope. The hotter, drier associations of the Series are more difficult to revegetate after a disturbance. Planning for limited water availability is the key to success.

**FIRE MANAGEMENT:** **TSHE/GASH/HIAL** is the hottest, driest Association of the Series (see the diagram at the beginning of the **TSHE** section). It has the lowest annual rainfall and supports many dry site indicators. Fire occurrence rate is 71 percent.

**RANGE & WILDLIFE MANAGEMENT:** Domestic range use potential is transitory. Forage averages 35 percent under natural stands, and shrub cover,

mostly salal, averages about 100 percent. Water sources are scarce and the terrain is steep. Browse for deer and elk consists of blackberry, thin-leaved huckleberry, Pacific dogwood, and hazel. However, production is low when compared with salal. A full vertical range of shrub and understory tree cover provides ample hiding and thermal cover, as well as habitat for birds and small mammals. No sensitive species were found in sample plots, however, slender-tubed iris, and gnome-plant may be present.

**RECREATION & VISUAL MANAGEMENT:** Visual and recreational character are similar to the average description given for the Series. Sites are typical forest with no unusual or outstanding features. **TSHE/GASH/HIAL** is slightly drier than the average **TSHE** site. Thus, it is slow to recover from disturbance, compaction or other damage from overuse, and requires greater than average effort to manage vegetation for screening, barriers, dust abatement, stabilization, or reduction of erosion. Travel, without trails, may be difficult. Shrub cover can be greater than 100 percent, and slopes are often steep.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	28%	7.5	3.5	co-climax resistant to drought, insects, and disease highly productive on moist sites pioneer, well adapted early seral
CADE3	incense-cedar	57%	7.8	3.3	
PILA	sugar pine	85%	8.3	3.8	
PIPO	ponderosa pine	28%	4.5	.7	
PSME	Douglas-fir	100%	42.9	17.5	
	TOTAL OVERSTORY	100%	57.9	14.1	
ABCO	—CONIFERS—				will regenerate and survive well under the average TSHE cover fire resistant will regenerate and survive well under the average TSHE cover pockets of high humidity moist conditions indicates recent fire history shallow, rocky soils
CADE3	white fir	85%	10.2	5.5	
	incense-cedar	100%	9.7	13.5	
PILA	sugar pine	28%	6.5	4.9	
PSME	Douglas-fir	85%	16.3	7.9	
TABR	Pacific yew	42%	5.7	1.2	
TSHE	western hemlock	100%	24.9	20.2	
	—HARDWOODS—				
ACCI	vine maple	57%	12.7	12.8	
ACMA	big-leaf maple	42%	5.7	4.0	
ARME	Pacific madrone	57%	7.5	5.0	
CACH	golden chinquapin	71%	8.4	3.2	
	TOTAL UNDERSTORY	100%	81.6	32.2	
AMAL	western serviceberry	14%	3.0	.0	deep, fertile soils
BENE	dwarf Oregongrape	100%	10.7	7.1	
BEPI	Piper's Oregongrape	14%	5.0	.0	drier, rockier, less productive sites than where BENE occurs
CHUM	common prince's-pine	14%	4.0	0	warm and dry, well-drained soils
CONU	Pacific dogwood	85%	11.8	7.0	
COCOC	California hazel	57%	8.8	11.1	occurs at driest extremes
GASH	salal	100%	52.9	22.1	
HODI	creambush ocean-spray	28%	24.0	22.6	shallow, well-drained soil, generally low in nutrients
LOHI	hairy honeysuckle	28%	1.5	7	
RHMA	Pacific rhododendron	14%	2.0	.0	occurs at driest extremes
RHDI	poison oak	28%	1.5	7	
ROGY	baldhip rose	85%	3.2	3.4	cool, moist forests
RULE	black raspberry	14%	1.0	.0	
RUNI	snow bramble	28%	2.5	7	not on cold, frosty sites
RUUR	Pacific blackberry	71%	2.4	1.9	
SYAL	common snowberry	14%	3.0	0	occurs at driest extremes
SYMO	creeping snowberry	85%	4.3	5.3	
VAPA	red huckleberry	57%	2.5	1.7	
WHMO	whipplevine	100%	5.9	4.9	
	TOTAL SHRUB	100%	104.9	42.0	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	85%	5.0	3.6	abundance indicates relatively little soil drought hot, dry sites  generally productive sites
ADBI	trail-plant, pathfinder	42%	1.7	.6	
ANDE	threeleaf anemone	71%	1.4	.5	
ARMA3	bigleaf sandwort	14%	1.0	0	
ARLA	mountain arnica	14%	1.0	.0	
ASCA3	western wild ginger	14%	1.0	.0	
ASHA	marbled wild ginger	42%	2.0	1.0	
CAPR3	California harebell	28%	1.0	.0	
CASC2	rough harebell	28%	1.5	.7	
COHE	varied-leaved collomia	14%	1.0	.0	
DIHOO	Oregon fairybell	42%	1.7	1.2	
EPMI	small-fl'd willow-herb	14%	1.0	.0	
FRVEB	woods strawberry	42%	1.3	.6	
GAAP	catchweed bedstraw	57%	1.5	.6	
GAOR	Oregon bedstraw	14%	1.0	.0	
GOOB	rattlesnake-plantain	85%	1.0	0	
HIAL	white-flowered hawkweed	100%	1.3	.5	
HYMO	fringed pinesap	14%	1.0	.0	
IRIS	iris spp.	14%	1.0	.0	
LAPO	leafy peavine	28%	3.0	2.8	
LIBOL	western twinflower	71%	9.6	11.5	
MAMA	woodland tarweed	14%	1.0	.0	
OSCH	mountain sweet-root	14%	1.0	.0	
PHAD	woodland phlox	14%	1.0	.0	
POHE	dwarf desert knotweed	14%	1.0	.0	
POMU	western sword-fern	85%	6.7	5.9	
PTAQ	bracken	42%	2.3	2.3	
PYDE	toothleaf pyrola	14%	1.0	.0	
SAXIF	saxifrage spp.	14%	5.0	.0	
SMST	starry Solomon-plume	14%	1.0	.0	
SYRE	snow-queen	57%	3.3	2.1	
THMO	mountain thermopsis	14%	1.0	.0	
TRLA2	western starflower	85%	1.5	.8	
TROV	white trillium	28%	1.0	.0	
VAHE	white inside-out-flr	71%	1.6	.9	
VIAM	American vetch	14%	1.0	.0	
VIAD	early blue violet	14%	4.0	.0	
VIGL	stream violet	14%	2.0	0	
VIOR2	round-leaved violet	14%	1.0	.0	
XETE	common beargrass	14%	2.0	.0	
	TOTAL HERB	100%	35.4	13.0	
BRER	meadow brome	14%	1.0	.0	
BRPA	Pacific brome	28%	1.0	.0	
FESTU	fescue spp.	14%	1.0	.0	
FEOC	western fescue	42%	1.0	0	
	TOTAL GRASS	100%	1.3	8	

**WESTERN HEMLOCK / DOUGLAS MAPLE / WESTERN TWINFLOWER**  
*Tsuga heterophylla* / *Acer glabrum* / *Linnaea borealis longiflora*  
**TSHE/ACGL/LIBOL**

**EXTENT:** TSHE/ACGL/LIBOL occurs on Butte Falls and Prospect Ranger Districts of the Rogue River National Forest, but rarely on the North Umpqua District. It possibly occurs on the Diamond Lake Ranger District. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** Salal and Pacific rhododendron are absent, but Douglas maple and Pacific yew are common to abundant. Typically, Douglas-fir dominates the overstory with white fir occasionally mixing with dominant western hemlock. TSHE/ACGL/LIBOL is a cool, dry Association unique to Southwest Oregon.

**ABIOTIC ENVIRONMENT:** Parent rock type is similar to the typical Cascade conditions. Basalt and andesite are the most common parent rock, followed by pumice and ash. All gradations from andesite to basalt, and ash to pumice may be present. In the former, composition shifts from acidic toward basic, with basalt usually most fertile, in the latter, the difference is mainly size class. See the discussion on the Western Cascade and High Cascade subprovinces.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3867.0	216.0
Aspect (deg)	301.9	96.8
Slope (%)	29.6	22.7
Total soil depth (in)	47.9	5.50
Rooting depth (in)	48.5	4.0
Total basal area (ft <sup>2</sup> /ac)	311.4	68.2

**CLIMATE:** TSHE/ACGL/LIBOL is the only cool, dry Association. Temperatures are cooler than the average TSHE site, but about equal to the average for the Cascades. However, dry season rainfall is 0.8 inches lower than the Series average. Although cold temperature may limit decomposition rates, frost is not likely to be a killer on most sites. Moisture stress annually reduces growth rates.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.1	.7
Maximum month temp(F)	79.1	.9
Mean annual ppt (in)	54.3	9.8
Dry season ppt (in)	7.4	1.3

**FOREST FLOOR:** Forest floor conditions are similar to the Cascade and Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss cover is usually about 7 percent, but on these cold sites, it is less. The low moss cover indicates cold temperature and relatively slow decomposition rates.

FOREST FLOOR	MEAN	S.D.
Litter (%)	90.7	9.5
Moss (%)	6.7	3.9
Bareground (%)	2.4	3.1
Gravel (%)	2.0	2.4
Rock (%)	4.3	5.4
Bedrock (%)	.0	0

**VEGETATION:** It is unusual to have ponderosa pine and Englemann spruce in the same association. Ponderosa, often a product of fire, indicates the hottest conditions or most intensely disturbed sites in the Cascade Province. Spruce, on the other hand, indicates the cool, moist-wet sites. Spruce is usually found in microsites such as drainages that infrequently burn and is sometimes found on sites near drainages. Ponderosa pine, atypical of the Association, is found scattered in the overstory, usually several decades older than the younger, more continuous component of the canopy, on plots that have a history of burning.

**SILVICULTURE:** Western hemlock is probably the most efficient biomass producer with Douglas-fir, big-leaf maple, and white fir close behind. Sugar pine is productive on warmer sites, and incense-cedar can tolerate most extremes. Englemann



spruce, rare in this Association, prefers the wettest, coolest habitats of the Series: stream courses or saturated depressions. Although lodgepole pine can survive extremes, it competes poorly with other species on productive sites throughout a rotation. Western white pine is productive on most sites. Potential for natural regeneration is moderate. Partial canopy cover would increase the recruitment of western hemlock. Controlling vegetation may be necessary to achieve growth goals. Big-leaf maple, snowbrush, chinquapin, and vine maple are the most serious competitors.

**WATERSHED MANAGEMENT:** TSHE/ACGL/LIBOL is typical of the TSHE Series. See the Series description for specific information.

**FIRE MANAGEMENT:** Although TSHE/ACGL/LIBOL supports the typical Series species mix, it receives less precipitation than all but TSHE/GASH/HIAL (estimated average annual rainfall is 54 inches). Forty three percent of the plots sampled were burned.

**RANGE & WILDLIFE MANAGEMENT:** Pacific rhododendron and salal usually are absent in

TSHE/ACGL/LIBOL. Blackberries, dogwood, and California hazel do provide some wildlife browse. Shrub cover averages 67 percent, herb cover averages about 60 percent, and is usually over 30 percent. Potential for domestic use is low, sites are steep, water sources are scarce, soils are generally rocky and shallow, and grasses and forage will require considerable encouragement to survive and produce for more than just a few years following disturbance.

**RECREATION & VISUAL MANAGEMENT:** Visual and recreational character are similar to the average description given for the Series. Sites are typical forest, relatively cool, moist and floristically rich, with no unusual or outstanding features. Off-trail hiking in TSHE/ACGL/LIBOL can be pleasant. Brush cover is usually low and scattered and slopes average less than 30 percent. There is a variety of spring wildflowers and the brilliant red hues of Douglas maple in the fall add to visual variety. Some sites support Pacific dogwood, which stands out in spring as eye-catching white pokadots, even from afar and flaming red vertical stripes in the fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	85%	27.2	22.9	generalist, efficient producer
CADE3	incense-cedar	42%	8.0	1.7	generalist, tolerates soil and climate extremes
PILA	sugar pine	14%	10.0	.0	productive on warmer sites
PIMO	western white pine	42%	4.0	3.6	cold sites, frost tolerant
PSME	Douglas-fir	100%	39.4	24.1	pioneer after disturbance, efficient biomass producer
TSHE	western hemlock	28%	27.5	24.7	the most efficient biomass producer
	TOTAL OVERSTORY	100%	77.1	10.8	
	—CONIFERS—				
ABCO	white fir	85%	14.5	8.5	generalist, efficient producer
CADE3	incense-cedar	57%	5.5	2.6	tolerates soil and climatic extremes
PIEN	Engelmann spruce	14%	2.0	.0	found on infrequently burned sites
PSME	Douglas-fir	14%	15.0	.0	efficient biomass producer
TABR	Pacific yew	85%	17.2	12.1	sites with higher than average humidity
TSHE	western hemlock	100%	27.9	15.8	the most efficient biomass producer, shade tolerant, climax species
	—HARDWOODS—				
ACCI	vine maple	28%	20.0	.0	moderate competitor in young plantations
ACGL	Douglas maple	100%	10.1	10.8	tolerates dry and rocky to moist slopes
ACMA	big-leaf maple	14%	60.0	.0	severe competitor in young plantations
CACH	golden chinquapin	14%	12.0	.0	indicates shallow rocky soils
	TOTAL UNDERSTORY	100%	86.7	23.2	
AMAL	western serviceberry	28%	6.0	5.7	
BENE	dwarf Oregongrape	85%	26.7	17.5	
BEPI	Piper's Oregongrape	28%	3.0	2.8	
CHME	little prince's-pine	14%	1.0	.0	
CHUM	common prince's-pine	85%	2.8	2.0	
CONU	Pacific dogwood	42%	11.7	6.5	provides wildlife browse
COCOC	California hazel	85%	11.7	11.8	provides wildlife browse
HODI	creambush ocean-spray	28%	10.5	13.4	warm, dry local conditions
PAMY	Oregon boxwood	42%	1.3	.6	
RIBES	currant spp.	14%	2.0	0	provides food for birds
RIBI	Siskiyou gooseberry	14%	1.0	.0	provides food for birds
RIVI	sticky currant	14%	2.0	.0	provides food for birds
ROGY	baldhip rose	100%	3.1	1.7	hips are high in vitamin C
RULA	dwarf bramble	14%	1.0	.0	provides food for birds
RUNI	snow bramble	14%	1.0	0	
RUPA	thimbleberry	14%	5.0	.0	provides food for birds
RUUR	Pacific blackberry	71%	4.2	1.9	excellent deer browse
SYAL	common snowberry	14%	2.0	.0	
SYMO	creeping snowberry	85%	11.7	18.9	
WHMO	whipplevine	57%	4.5	4.0	
	TOTAL SHRUB	100%	67.3	37.6	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	57%	10.5	6.1	moist sites, deep, well drained soil
ADBI	trail-plant, pathfinder	71%	5.0	3.3	
ANDE	threeleaf anemone	85%	2.5	1.4	
ARMA3	bigleaf sandwort	14%	1.0	0	
ARLA	mountain arnica	14%	5.0	0	occurs on wetter sites
ASCA3	western wild ginger	42%	2.0	1.7	
ASHA	marbled wild ginger	14%	1.0	.0	
CABU2	fairy-slipper	28%	1.0	.0	
CASC2	rough harebell	14%	1.0	.0	sites with frost and deep snow pack
CLUN	queen's cup	57%	2.3	.5	
COMA3	spotted coral-root	42%	1.0	.0	
COST2	hooded coral-root	14%	1.0	.0	
CYGR	Pacific hound's-tongue	14%	3.0	0	dry sites with shallow soils
DIFO	Pacific bleedingheart	14%	1.0	.0	
DIHOO	Oregon fairybell	85%	3.5	5.6	low palatability to animals quite tasty
FRVEB	woods strawberry	42%	1.0	.0	
GAAP	catchweed bedstraw	85%	1.2	.4	warm, disturbed sites
GOOB	rattlesnake-plantain	71%	1.2	.4	
HEMI	smallflower alumroot	42%	2.3	2.3	
HAL	white-flowered hawkweed	28%	2.0	1.4	
IRIS	iris spp.	14%	1.0	.0	nitrogen fixer
LAPO	leafy peavine	14%	5.0	.0	
UCO4	tiger lily	14%	1.0	.0	abundance indicates relatively little soil drought
LIBOL	western twinflower	100%	16.0	15.4	
MOSI	candyflower	14%	2.0	.0	
OSCH	mountain sweet-root	57%	3.3	1.7	
PERA	leafy lousewort	42%	1.0	.0	productive sites
PHAD	woodland phlox	28%	1.5	.7	
POMU	western sword-fern	14%	2.0	0	may be allelopathic
POTEN		14%	1.0	.0	
PTAQ	bracken	28%	6.0	5.7	hot, dry sites
PYPI	whitevein pyrola	42%	1.0	.0	
SADO	yerba buena	14%	1.0	0	cool sites
SEBO	Bolander's groundsel	14%	4.0	.0	
SMRA	western false Solomon's-seal	28%	1.5	.7	moist sites
SMST	starry Solomon-plume	100%	2.6	1.9	
SYRE	snow-queen	71%	2.0	1.7	warm, moist sites, lower elevations
TRLA2	western starflower	85%	2.2	1.6	
TROV	white trillium	85%	1.0	.0	warm, moist sites
VAHE	white inside-out-flr	71%	3.8	3.6	
VECA	Calif. false hellebore	14%	1.0	.0	mesic sites
VIAD	early blue violet	14%	2.0	.0	
VIGL	stream violet	57%	1.0	0	mesic sites
VIOR2	round-leaved violet	28%	1.0	.0	
	TOTAL HERB	100%	57.7	19.4	
BRPA	Pacific brome	42%	2.3	2.3	
CAREX	sedge spp.	14%	1.0	.0	
FEOC	western fescue	28%	1.0	0	
MELIC		14%	1.0	.0	
	TOTAL GRASS	100%	1.6	1.6	

**WESTERN HEMLOCK / DWARF OREGONGRAPE / WESTERN TWINFLOWER**  
*Tsuga heterophylla* / *Berberis nervosa* / *Linnaea borealis longiflora*  
**TSHE/BENE/LIBOL**

**EXTENT:** TSHE/BENE/LIBOL occurs throughout the Western Cascade Subprovince. It is most common on Prospect, North Umpqua, and Diamond Lake Ranger Districts. It occurs less often on the Cottage Grove and Butte Falls Ranger Districts. N = 25 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/BENE/LIBOL is a common, widely occurring, highly variable Association. It has few characteristics that distinguish it from TSHE/BENE/ACTR (SWO), except for the abundance of vine maple, Pacific yew, and dwarf Oregongrape. It represents the average environment of the Series. It is similar to TSHE/BENE associations of the Northwest.

**ABIOTIC ENVIRONMENT:** Parent rock types include basalt, andesite (the most common), pumice, ash, granite and mixed intrusives. Soils are deep, fertile, and resilient. There are no known operational constraints. Northerly aspects are most common, and elevations are near the Cascade average.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3431.0	669.0
Aspect (deg)	6.5	123.9
Slope (%)	28.7	19.1
Total soil depth (in)	39.4	14.3
Rooting depth (in)	45.7	8.8
Total basal area (ft <sup>2</sup> /ac)	254.4	83.4

**CLIMATE:** TSHE/BENE/LIBOL is a typical moderate climate, close to the average Series temperatures, but slightly drier. Biomass production is most limited by lack of moisture, late in the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.2	1.8
Maximum month temp(F)	80.8	2.7
Mean annual ppt (in)	58.8	9.4
Dry season ppt (in)	7.8	1.1

**FOREST FLOOR:** Forest floor conditions are similar to the Western Hemlock Series average where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 24 percent.

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.3	5.2
Moss (%)	24.0	24.9
Bareground (%)	.5	1.1
Gravel (%)	1.7	4.5
Rock (%)	4.6	9.2
Bedrock (%)	.3	.8

**VEGETATION:** Vegetation dominants are typical of the Series. TSHE/BENE/LIBOL is a "run of the mill" Western Hemlock Association. The drier environments support incense-cedar, whipplevine, and snowberry. Golden chinquapin, common on many sites, often indicates shallow or nutritionally imbalanced soils. Its usual occurrence on ridgetops is consistent with such an interpretation.

**SILVICULTURE:** Fifteen tree species occur in TSHE/BENE/LIBOL. It is one of the most diverse Associations of the Series. Typical of the Series, Douglas-fir and western hemlock are the most common. Douglas fir dominating the upper layers of the canopy and western hemlock dominating the lower, other species are scattered vertically throughout the stand. Sugar pine, incense-cedar and Pacific madrone are well adapted and productive. White fir, lodgepole pine, and western white pine perform well on the cooler sites. Shasta red fir and silver fir occur rarely, on the very coolest sites. Ponderosa pine, canyon live oak, and golden chinquapin are pioneers, particularly on the drier, less productive sites. Big-leaf maple and Pacific yew occupy the concave, humid microsites. Potential for natural regeneration is high. Most sites have few environmental limitations and a variety of species which gives considerable resilience when disturbed. Composition may depend on what species is having a good seed year

and the coincident weather. Some control may be exerted by timing harvest, manipulation of the canopy, and treatment of the forest floor. Big-leaf maple and snowbrush are the most likely species to reduce crop tree growth. The need for vegetation management, however, is relatively low on most sites. Most sites, particularly with a variety of species, do not stagnate. Mixed stands should be monitored for stocking level control needs. Not much is known about density management in such diverse stands.

**WATERSHED MANAGEMENT:** TSHE/BENE/LIBOL is typical of the average association in the Series. The description given in the Series Summary provides information characterizing the typical or average watershed condition.

**FIRE MANAGEMENT:** Species composition is typical of the Series, except for a slightly higher constancy of vine maple and western redcedar. The Series description provides applicable information on the general fire regime. Six of the 25 plots (24 percent) had fire evidence.

#### **RANGE & WILDLIFE MANAGEMENT:**

Forb cover is low (30 percent), and not much is known about wildlife use. Shrub cover is also low (32 percent), dominated by *Rubus* species, California hazel, Pacific dogwood, and Oregon boxwood. Pacific rhododendron and salal usually are absent. Grasses are rare and would likely be subordinate to forbs, shrubs, and tree regeneration after harvest. Structural diversity is high. Downed logs, snags, duff, and various sizes of trees and shrubs are present in 150 year old stands.

**RECREATION & VISUAL MANAGEMENT:** Visual and recreational character are similar to the average description given for the Series. Sites are typical hemlock forest, cool, moist and floristically rich, with no unusual or outstanding features. Typically mid-slope and gentle (average slope is less than 30 percent), brush cover is sparse and off-trail hiking can be pleasant. Ephemeral streams are not as common in TSHE/BENE/LIBOL as in other associations, but access to water in most years is within a half mile. Vine maple provides fall color, particularly in clearcuts, and trailing blackberry may provide some edible fruit in the more open stands.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	4%	1.0	.0	rare in this Association
ABCO	white fir	32%	15.6	8.2	performs well on cooler sites
ABMAS	Shasta red fir	4%	10.0	.0	rare in this Association
CADE3	incense-cedar	20%	7.6	3.2	generalist, tolerates soil and climate extremes
PILA	sugar pine	24%	9.8	3.4	well adapted and productive
PIMO	western white pine	20%	13.0	9.1	performs well on cooler sites
PSME	Douglas-fir	96%	36.1	15.1	common, pioneer after disturbance
TSHE	western hemlock	56%	19.6	14.5	often dominates lower layer
	TOTAL OVERSTORY	100%	57.6	17.9	
	---CONIFERS---				
ABCO	white fir	88%	16.1	11.8	generalist, efficient producer
CADE3	incense-cedar	36%	4.2	3.1	tolerates soil and climatic extremes
PILA	sugar pine	4%	1.0	.0	productive on warmer sites
PSME	Douglas-fir	52%	15.8	9.0	often dominates upper canopy layers
TABR	Pacific yew	64%	14.4	17.2	occupies concave, humid microsites
TSHE	western hemlock	100%	39.4	20.5	dominates lower canopy layers
	---HARDWOODS---				
ACCI	vine maple	72%	39.3	27.7	
ACGL	Douglas maple	4%	1.0	.0	tolerates dry and rocky to moist slopes
ACMA	big-leaf maple	24%	12.2	10.8	occupies concave, humid microsites
ARME	Pacific madrone	7%	2.0	1.4	well adapted and productive
CACH	golden chinquapin	40%	6.3	5.7	pioneer on drier, less productive sites
QUCH	canyon live oak	4%	20.0	.0	pioneer on drier, less productive sites
	TOTAL UNDERSTORY	100%	107.3	29.4	
AMAL	western serviceberry	16%	1.5	.6	
BENE	dwarf Oregongrape	96%	15.5	16.8	deep, fertile soils
BEPI	Piper's Oregongrape	4%	1.0	.0	drier, rockier less productive sites than BENE
CHME	little prince's-pine	20%	1.0	.0	low light levels
CHUM	common prince's-pine	84%	3.4	3.6	dry sites
CONU	Pacific dogwood	32%	7.6	7.9	
COST	red-osier dogwood	4%	1.0	.0	
COCOC	California hazel	32%	3.6	2.6	
GAOV	slender salal	7%	3.0	2.8	cool, moist sites
GASH	salal	16%	4.5	3.5	warmer, drier sites
LOCI	trumpet honeysuckle	12%	1.3	.6	
OECE	Indian plum	4%	1.0	0	
PAMY	Oregon boxwood	40%	2.9	2.2	cool sites
RHMA	Pacific rhododendron	12%	4.0	1.7	usually absent
RILA	swamp gooseberry	7%	2.0	1.4	provides food for birds
ROGY	baldhip rose	76%	1.7	1.1	hips are high in vitamin C
RULA	dwarf bramble	7%	2.0	.0	provides food for birds
RUNI	snow bramble	32%	3.9	3.8	provides food for birds
RUUR	Pacific blackberry	92%	2.1	1.5	preferred deer browse
SYMO	creeping snowberry	44%	1.8	1.3	disturbance indicator
VAME	thin-leaved huckleberry	32%	2.1	1.5	excellent for berry picking
VAPA	red huckleberry	32%	1.9	.8	good for berry picking
WHMO	whipplevine	44%	3.4	3.5	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	32.6	25.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	68%	2.6	1.9	moist sites, deep, well drained soil
ACRU	baneberry	7%	1.5	.7	
ADBI	trail-plant, pathfinder	36%	1.8	1.4	common
ALVI	candystick	4%	1.0	.0	
ANDE	threeleaf anemone	56%	1.1	.3	common, mesic sites
ARMA3	bigleaf sandwort	7%	1.0	0	
ARLA	mountain arnica	4%	1.0	.0	open forests or meadows
ASCA3	western wild ginger	36%	2.1	1.5	occurs on wetter sites
ASHA	marbled wild ginger	28%	1.6	1.1	
CASC2	rough harebell	16%	1.8	1.5	
CLUN	queen's cup	48%	1.5	.7	indicates cool, moist sites
COLA	cutleaf goldthread	12%	2.3	.6	
COME	Pacific coral-root	12%	1.0	0	
COST2	hooded coral-root	4%	1.0	.0	
COCA	bunchberry	4%	2.0	.0	cool, mesic sites
DIHOO	Oregon fairybell	48%	1.3	.6	
FRVEB	woods strawberry	7%	2.0	1.4	quite tasty
GAAP	catchweed bedstraw	36%	1.0	.0	
GAOR	Oregon bedstraw	4%	1.0	0	
GOOB	rattlesnake-plantain	76%	1.1	.2	
HAL	white-flowered hawkweed	24%	1.0	.0	warm, dry, disturbed sites
HYMO	fringed pinesap	4%	1.0	0	
LATHY		4%	1.0	0	
LAPO	leafy peavine	4%	1.0	.0	fixes nitrogen
LIWA	Washington lily	4%	1.0	.0	
LIBOL	western twinflower	92%	10.0	7.6	ubiquitous
MITR2	three-tooth mitrewort	4%	1.0	0	cool
MOUN2	Indian-pipe	16%	1.0	.0	
MOSI	candyflower	4%	1.0	.0	moist sites
NEHE	small white nemophila	4%	1.0	.0	
OSCH	mountain sweet-root	7%	1.0	.0	
PERA	leafy lousewort	4%	3.0	.0	
PHLOX		4%	1.0	0	
PHAD	woodland phlox	4%	2.0	0	
PLFI2	Sierra-sap	4%	1.0	.0	
POHE	dwarf desert knotweed	4%	1.0	0	
POMU	western sword-fern	60%	5.7	7.3	productive sites
PTAQ	bracken	16%	3.8	4.3	possibly allelopathic
PTAN	woodland pinedrops	12%	1.0	0	
PYAP	leafless pyrola	4%	1.0	0	
PYAS	alpine pyrola	4%	1.0	0	late successional
PYP1	whitevein pyrola	32%	1.1	.4	
PYSE	one-sided pyrola	16%	1.0	0	cool, moist conifer forests
SEBO	Bolander's groundsel	16%	1.0	0	
SMRA	western false Solomon's-seal	20%	1.0	0	
SMST	starry Solomon-plume	44%	3.3	4.2	generally cool sites
SYRE	snow-queen	52%	1.5	1.2	
TITR	foamflower	40%	2.2	1.6	moist environment
TRLA2	western starflower	52%	1.5	.8	mid successional
TROV	white trillium	76%	1.2	.4	part of the mesic middle indicators
VAHE	white inside-out-flr	48%	1.5	.7	part of the mesic middle indicators
VECA	Calif. false hellebore	7%	1.5	.7	
VIAM	American vetch	12%	1.0	.0	
VIAD	early blue violet	4%	2.0	0	
VIGL	stream violet	40%	1.4	.7	early successional
VIOR2	round-leaved violet	36%	1.7	1.3	mesic sites
XETE	common beargrass	4%	1.0	0	responds quickly after fire by resprouting
	TOTAL HERB	100%	30.2	14.8	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BROMU	brome spp.	7%	1.0	.0	
BRPA	Pacific brome	4%	1.0	.0	
CAREX	sedge spp.	7%	1.0	.0	
FESTU	fescue spp.	4%	1.0	.0	
FEOC	western fescue	7%	1.0	.0	
FERU	red fescue	4%	1.0	.0	
LUPA	smallflowered woodrush	7%	1.0	.0	
	TOTAL GRASS	100%	.5	.9	



**WESTERN HEMLOCK / DWARF OREGONGRAPE / VANILLALEAF (SWO)**  
*Tsuga heterophylla* / *Berberis nervosa* / *Achlys triphylla* (SWO)  
**TSHE/BENE/ACTR (SWO)**

**EXTENT:** TSHE/BENE/ACTR (SWO) occurs on the Butte Falls, Prospect, Tiller, and North Umpqua Ranger Districts. N = 11 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/BENE/ACTR (SWO) is compositionally similar to TSHE/BENE/LIBOL except for the difference in abundance of twinflower, vanillaleaf, golden chinquapin, and Pacific yew. TSHE/BENE/ACTR (SWO) often supports grasses, particularly Pacific brome and western fescue. It is similar to TSHE/BENE associations found in the Northwest.

**ABIOTIC ENVIRONMENT:** Parent rock type is basalt or andesite. Pumice and ash only occasionally support TSHE/BENE/ACTR (SWO). Refer to the discussion presented in the Series summary on the Western Cascade and High Cascade Subprovinces. Aspect, elevation, and slope are typical for common modal Cascade sites.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3897.0	485.0
Aspect (deg)	356.5	105.7
Slope (%)	35.8	17.8
Total soil depth (in)	43.7	8.3
Rooting depth (in)	47.7	5.2
Total basal area (ft <sup>2</sup> /ac)	296.4	84.8

**CLIMATE:** TSHE/BENE/ACTR (SWO) is cooler than TSHE/BENE/LIBOL. Temperatures are lower than the average Cascade site. Vanillaleaf indicates cooler conditions than twinflower. Dry season rainfall is slightly higher than the Series average. TSHE/BENE/ACTR (SWO) is nearer the cool, moist end of the environmental gradient. Yet, water is the most limiting factor affecting biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.9	1.3
Maximum month temp(F)	78.9	2.0
Mean annual ppt (in)	60.0	9.5
Dry season ppt (in)	8.4	1.4

**FOREST FLOOR:** Except for low moss cover (8 percent), forest floor conditions are similar to the average conditions for the Cascade and Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss cover is positively related to estimated temperature. Since TSHE/BENE/ACTR (SWO) is relatively cool, (see Figure 10) moss cover would be low.

FOREST FLOOR	MEAN	S.D.
Litter (%)	93.8	6.2
Moss (%)	7.5	8.2
Bareground (%)	2.6	3.0
Gravel (%)	1.3	1.4
Rock (%)	2.6	2.1
Bedrock (%)	.1	.3

**VEGETATION:** TSHE/BENE/ACTR (SWO) is a typical TSHE association with the standard complement of vegetation, characteristic of most associations. Abundant vanillaleaf, white inside-out-flower, threeleaf anemone, and swordfern are indicative of the moderate, moist conditions of the Association. Early successional herbs include groundsel, fireweed, strawberry, and bracken fern.

**SILVICULTURE:** TSHE/BENE/ACTR (SWO) is a widely occurring, typical Cascade Association which supports a variety of tree species (13). High diversity provides immediate and future management options. The most important is maintaining both diversity and options. The most versatile trees are Douglas-fir, incense-cedar and white fir. Western hemlock is also well adapted and productive. Like Douglas-fir, it produces well in early seral stages on TSHE/BENE/ACTR (SWO). Silver fir, mountain hemlock, Shasta red fir, and western white pine produce best on the coolest sites or microsites. They are more specialized than the first four mentioned. Sugar pine is possibly the fastest growing species. Growth rates are excellent, but its distribution is scattered. It rarely constitutes over 30 percent of stand basal area. The use of rust resis-

tant stock may help to increase density, but little is known about its capability when competing with itself. Ponderosa pine, a pioneer, Pacific yew, a climax associate, golden chinquapin, and madrone are also appropriate for various revegetation, wildlife, and aesthetic uses. **TSHE/BENE/ACTR (SWO)** has a high potential for natural regeneration. Any combination of species mentioned above would be appropriate biologically. Most other species that occur in the southern Cascades could survive here. The need for managing competition is usually low, but the need for thinning can be high.

**WATERSHED MANAGEMENT:** Except for its tendency to occur on the mid third slope position, **TSHE/BENE/ACTR (SWO)** is typical of the average association in the Series. Refer to the Series Summary for a description.

**FIRE MANAGEMENT:** **TSHE/BENE/ACTR (SWO)** is totally typical of the Series, and represents the

"type" or typical association of the Series (refer to the Series summary). Thirty six percent of the sampled plots were burned.

**RANGE & WILDLIFE MANAGEMENT:** Forb cover averages 82 percent under a full forest canopy, and is seldom less than 35 percent. Grass cover is sparse (less than 1 percent). Unlike many climax hemlock sites, Pacific rhododendron and salal do not dominate the site. *Rubus* species, California hazel, and Pacific dogwood are the shrubby dominants and likely the preferred browse. Range opportunities are transitory. Structure for wildlife is diverse.

**RECREATION & VISUAL MANAGEMENT:** Visual and recreational character are typical hemlock sites, relatively cool, moist and floristically rich. Refer to the Series description.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	81%	16.3	7.6	generalist, highly productive produce best on coolest sites generalist, tolerates soil and climatic extremes possibly the fastest growing species in this Association produces best on coolest sites generalist highly productive
ABMAS	Shasta red fir	9%	2.0	.0	
CADE3	incense-cedar	36%	5.5	3.3	
PILA	sugar pine	18%	6.5	2.1	
PIMO	western white pine	9%	5.0	.0	
PSME	Douglas-fir	100%	37.7	19.4	
TSHE	western hemlock	63%	22.6	10.4	
	TOTAL OVERSTORY	100%	69.3	9.8	
ABAM	—CONIFERS— Pacific silver fir	9%	2.0	.0	produces best on coolest sites generalist, highly productive produces best on coolest sites tolerates soil and climatic extremes more seral in behavior pioneer after disturbance sites with high atmospheric moisture highly productive
ABCO	white fir	90%	23.0	8.6	
ABMAS	Shasta red fir	9%	2.0	.0	
CADE3	incense-cedar	54%	6.7	4.9	
PILA	sugar pine	9%	2.0	.0	
PSME	Douglas-fir	18%	12.5	10.6	
TABR	Pacific yew	81%	10.4	8.2	
TSHE	western hemlock	100%	25.0	14.8	
ACCI	—HARDWOODS— vine maple	63%	30.0	22.7	indicates shallow, rocky soils
CACH	golden chinquapin	72%	6.6	6.1	
	TOTAL UNDERSTORY	100%	84.8	31.4	
AMAL	western serviceberry	18%	1.5	.7	deep fertile soils
BENE	dwarf Oregongrape	100%	25.4	22.4	
CHME	little prince's-pine	18%	1.5	.7	dry site indicator
CHUM	common prince's-pine	63%	6.9	3.8	
CONU	Pacific dogwood	36%	16.2	29.2	provides deer browse
COCOC	California hazel	45%	9.6	5.3	provides deer browse
HODI	creambush ocean-spray	18%	16.0	19.8	warmer sites
OECE	Indian plum	9%	1.0	.0	cool sites
PAMY	Oregon boxwood	18%	2.5	.7	
RILA	swamp gooseberry	9%	1.0	.0	provides food for birds
ROGY	baldhip rose	72%	5.5	5.0	hips are high in vitamin C
RULA	dwarf bramble	9%	3.0	.0	provides food for birds
RULE	black raspberry	9%	1.0	.0	provides food for birds
RUNI	snow bramble	36%	4.3	1.0	provides food for birds, cool, moist sites
RUPA	thimbleberry	9%	1.0	.0	provides food for birds
RUUR	Pacific blackberry	81%	6.2	4.1	good deer browse
SYAL	common snowberry	9%	2.0	.0	indicator of disturbance
SYMO	creeping snowberry	72%	7.0	6.2	
VAME	thin-leaved huckleberry	36%	3.5	2.4	cool sites with well-drained acidic soils
VAPA	red huckleberry	18%	3.0	2.8	early to mid successional
WHMO	whipplevine	81%	7.8	7.7	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	68.6	43.9	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	100%	22.5	12.6	moist sites, deep, well-drained soil
ACRU	baneberry	9%	1.0	.0	
ADBI	trail-plant, pathfinder	81%	6.9	12.6	common
ANDE	threeleaf anemone	72%	2.1	.8	common, mesic sites
ARMA3	bigleaf sandwort	27%	1.0	.0	
ASCA3	western wild ginger	18%	2.0	1.4	occurs on wetter sites
ASHA	marbled wild ginger	45%	1.0	.0	
CAPR3	California harebell	9%	2.0	.0	
CASC2	rough harebell	45%	3.4	2.5	
CLUN	queen's cup	63%	2.6	1.5	indicates cool, moist sites
COMA3	spotted coral-root	27%	1.0	.0	
COME	Pacific coral-root	9%	1.0	.0	
COST2	hooded coral-root	9%	1.0	.0	
DIHOO	Oregon fairybell	100%	1.6	1.0	
FRVEB	woods strawberry	45%	1.2	.4	excellent for berry picking
GAAP	catchweed bedstraw	45%	1.6	1.3	
GAOR	Oregon bedstraw	18%	1.5	.7	
GOOB	rattlesnake-plantain	54%	1.0	.0	
HECO	gnome-plant	18%	1.0	.0	
HAL	white-flowered hawkweed	36%	3.5	4.4	warm, dry, disturbed sites
LAPO	leafy peavine	36%	2.8	1.7	nitrogen fixer
LIBOL	western twinflower	90%	20.1	18.0	mid to late successional
MITR2	three-tooth mitrewort	9%	1.0	.0	cool sites
MOUN2	Indian-pipe	9%	1.0	.0	
MOSI	candyflower	18%	1.0	.0	moist sites
NEHE	small white nemophila	18%	1.0	0	
OSCH	mountain sweet-root	54%	1.2	.4	
PERA	leafy lousewort	27%	2.7	2.1	
PHAD	woodland phlox	18%	1.0	0	
PHSP	showy phlox	9%	1.0	.0	
POMU	western sword-fern	36%	16.0	13.4	productive sites
PTAQ	bracken	27%	2.3	1.5	indicates disturbance
PYPI	whitevein pyrola	54%	1.7	1.0	
PYSE	one-sided pyrola	45%	1.6	.9	cool, moist conifer forests
SADO	yerba buena	9%	1.0	.0	
SEBO	Bolander's groundsel	9%	1.0	.0	
SMRA	western false Solomon's-seal	18%	2.0	.0	
SMST	starry Solomon-plume	45%	4.0	2.7	generally cool sites
SYRE	snow-queen	54%	2.2	2.4	
TITR	foamflower	45%	3.2	1.8	moist environment
TRLA2	western starflower	100%	1.9	2.7	mid successional
TROV	white trillium	63%	1.0	.0	part of the mesic middle indicators
VAHE	white inside-out-flr	81%	3.9	3.1	part of the mesic middle indicators
VIAM	American vetch	27%	1.3	.6	possible nitrogen fixer
VIAD	early blue violet	9%	1.0	.0	
VIGL	stream violet	54%	1.5	.5	early successional
VIOR2	round-leaved violet	45%	1.6	.5	mesic sites
	TOTAL HERB	100%	82.0	26.2	
BRPA	Pacific brome	36%	2.0	1.2	
CAREX	sedge spp.	9%	2.0	.0	
FEOC	western fescue	27%	1.7	.6	
LUHI	smooth woodrush	9%	1.0	.0	
MESU	Alaska oniongrass	9%	1.0	.0	sea level to mid elevation, dry or moist
	TOTAL GRASS	100%	1.7	.8	

**WESTERN HEMLOCK - BIG-LEAF MAPLE / WESTERN SWORD-FERN**  
*Tsuga heterophylla* - *Acer macrophyllum* / *Polystichum munitum*  
**TSHE-ACMA/POMU**

**EXTENT:** TSHE-ACMA/POMU occurs on the North Umpqua and Tiller Ranger Districts. It may be associated with the Klamath or Western Cascade Subprovince. N = 8 plots.

**IDENTIFYING CHARACTERISTICS:** Western redcedar is abundant in the understory, spotty in the overstory, but always an important component of the Association. Both vine and big-leaf maples are abundant. Salal, swordfern, and Oregon oxalis are abundant although the tree canopy is thick.

**ABIOTIC ENVIRONMENT:** Parent rock type is typically igneous extrusive, such as granitics and diorite, materials associated with the Klamath Geological Province common on the Tiller Ranger District. Soils are deep, aspects face northeast, and elevations are low. There are no known operational constraints.

ABIOTIC	MEAN	S.D.
Elevation (ft)	1844.0	457.0
Aspect (deg)	43.4	101.5
Slope (%)	25.1	26.2
Total soil depth (in)	43.96	10.5
Rooting depth (in)	43.5	9.4
Total basal area (ft <sup>2</sup> /ac)	256.2	60.5

**CLIMATE:** Warm, moist conditions characterize TSHE-ACMA/POMU. Sites are significantly warmer than all other TSHE Associations. And although the rainfall is about average for the Series, the bottomland protected position tends to collect the marine air and maintain high humidity late in the day and the summer. It is more moist than indicated by precipitation figures. Nutrition probably limits biomass production on most sites, although moisture stress occurs most summers.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	50.3	1.0
Maximum month temp(F)	87.1	1.7
Mean annual ppt (in)	60.6	5.6
Dry season ppt (in)	8.0	.9

**FOREST FLOOR:** Except for very high moss cover, forest floor conditions are similar to the average Cascade and Western Hemlock Series conditions where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. High temperature and humidity foster high moss cover along with rapid decomposition rates.

FOREST FLOOR	MEAN	S D
Litter (%)	84.9	29.0
Moss (%)	60.0	20.2
Bareground (%)	1.0	1.1
Gravel (%)	2.1	3.0
Rock (%)	1.6	2.3
Bedrock (%)	.0	.0

**VEGETATION:** The vegetation is indicative of the marine influenced, moderate climate. Pacific dogwood, California hazel, and bigleaf maple grow well under thin cloud cover, low evaporative demand, and high humidity. In the more extreme conditions of early succession vine maple, Douglas-fir, and bigleaf maple seem a competitive advantage. They are more abundant in the early stages of succession.

**SILVICULTURE:** Western redcedar, red alder, western hemlock, and Douglas-fir are well adapted. Stands can be manipulated to favor the regeneration of any of the four. White fir (it has morphological characteristics similar to grand fir on bottomland sites) is not as efficient. Incense-cedar, Pacific yew, and western white pine rarely occur, but may be encouraged in specialized microsites. Hardwoods, big-leaf maple, madrone, and golden chinquapin also provide opportunities for enhancing diversity and habitat. TSHE-ACMA/POMU has a high potential for using natural regeneration. The potential for growth loss from hardwood competition is high. Besides the hardwoods, snowbrush and vine maple are potential target species. Stocking level control is usually necessary to reach planned growth rates.

**WATERSHED MANAGEMENT:** **TSHE-ACMA/POMU**, unlike the average association, tends to occur on bottomland benches where soils are sometimes shallow as a result of bank erosion. The climate is warm, and humid. Revegetation can be difficult on the shallow soiled, steep sites and relatively easy on flat silty benches.

**FIRE MANAGEMENT:** **TSHE-ACMA/POMU** is estimated to have the highest average annual temperature of the Series. Although it is in bottomland positions with high humidity, 50 percent of the sampled sites were burned. Whether these burns were natural or man-caused, is not known.

**RANGE & WILDLIFE MANAGEMENT:** Forb cover averages 53 percent, but can be as high as 120 percent. Blackberries, red huckleberry, Pacific dogwood, and California hazel are the most common browse species. Together they may average about 35 percent cover. Grasses are rare, and their development on disturbed sites may take some effort to establish and keep productive. Structure is diverse

and phantom orchard and slender-tube iris, considered rare, occur on **TSHE-ACMA/POMU**.

**RECREATION & VISUAL MANAGEMENT.** **TSHE-ACMA/POMU** is cooler and more moist than the average **TSHE** association. It tends to occur in humid bottomlands or draws adjacent to perennial streams. Western redcedar gives it different character and the fall yellow and red hues of bigleaf and vine maple and Pacific dogwood provide a striking contrast to the dark greens of the conifers. Pure white dogwood flowers, usually 2-3 inches in diameter, are a spring eye fest. Hiking ranges from pleasant to crawling through thickets of vine maple, salal, blackberry, and Oregon oxalis. Poison oak occasionally occurs on old terraces or rocky river banks. Most sites absorb use and are resilient. Revegetation of overused sites is not difficult, except near rocky water's edge. Here, willow, saxifrage, sedum species, and poison oak may be used to patch wounds of overuse.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	10.2	4.1	morphology may suggest grand fir
CADE3	incense-cedar	12%	5.0	.0	plant only in specialized microsites
PIMO	western white pine	12%	1.0	.0	plant only in specialized microsites
PSME	Douglas-fir	100%	37.1	17.9	well adapted
THPL	western redcedar	50%	18.7	9.5	well adapted
TSHE	western hemlock	62%	8.8	6.5	well adapted, highly productive
	TOTAL OVERSTORY	100%	57.9	17.1	
	—CONIFERS—				
ABCO	white fir	37%	11.0	3.6	morphology may suggest grand fir
CADE3	incense-cedar	12%	10.0	.0	plant only on specialized microsites
PSME	Douglas-fir	25%	16.0	19.8	well adapted
TABR	Pacific yew	50%	7.8	3.9	requires special microsites for planting
THPL	western redcedar	100%	19.0	12.0	well adapted
TSHE	western hemlock	100%	38.7	19.4	well adapted, highly productive
	—HARDWOODS—				
ACCI	vine maple	87%	27.9	18.0	very competitive in plantations
ACMA	big-leaf maple	100%	12.9	6.4	severe competitor in plantations
ALRU	red alder	12%	15.0	.0	very competitive in plantations, nitrogen fixer
ARME	Pacific madrone	12%	5.0	.0	drier sites
CACH	golden chinquapin	37%	2.7	.6	rocky sites or ridgetops
	TOTAL UNDERSTORY	100%	111.7	35.9	
AMAL	western serviceberry	12%	1.0	.0	
BENE	dwarf Oregongrape	87%	7.3	7.0	deep, fertile soils
CHME	little prince's-pine	12%	1.0	0	
CHUM	common prince's-pine	12%	1.0	.0	dry site indicator
CONU	Pacific dogwood	100%	9.8	7.1	provides deer browse, showy flowers
COST	red-osier dogwood	12%	2.0	.0	provides deer browse
COCOC	California hazel	75%	3.0	1.8	provides deer browse
GASH	salal	87%	6.4	4.4	warm, dry, well-drained sites
LOHI	hairy honeysuckle	12%	1.0	.0	hot, dry sites, often well-drained soils
OECE	Indian plum	12%	3.0	0	
RHMA	Pacific rhododendron	12%	1.0	.0	possible competitor in plantations
RHDI	poison oak	12%	1.0	0	hot, dry, or recently disturbed sites
ROGY	baldhip rose	25%	1.0	0	hips contain high amounts of vitamin C
RUPA	thimbleberry	25%	2.5	2.1	provides food for birds
RUSP	salmonberry	12%	3.0	.0	provides food for birds
RUUR	Pacific blackberry	62%	6.4	6.0	excellent deer browse
SYMO	creeping snowberry	12%	1.0	.0	indicator of disturbance
VAPA	red huckleberry	87%	2.3	1.4	good for berry picking
WHMO	whipplevine	50%	2.8	1.7	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	34.2	14.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	37%	2.0	1.7	moist sites, deep, well-drained soil
ACRU	baneberry	12%	1.0	.0	
ADBI	trail-plant, pathfinder	50%	2.8	2.2	common
ADPE	northern maidenhair	12%	1.0	.0	wet sites
ANDE	threeleaf anemone	50%	1.0	.0	common, mesic sites
ASCA3	western wild ginger	50%	3.3	1.3	occurs on wetter sites
ASHA	marbled wild ginger	37%	4.7	2.5	
CASC2	rough harebell	25%	1.0	.0	
CLUN	queen's cup	37%	1.0	.0	indicates cool, moist sites
COLA	cutleaf goldthread	50%	4.0	5.4	
DIHOO	Oregon fairybell	50%	1.0	0	
EBAU	phantom-orchid	12%	1.0	.0	
FRVEB	woods strawberry	12%	1.0	.0	quite tasty
GAAP	catchweed bedstraw	87%	1.1	.4	
GOOB	rattlesnake-plantain	62%	1.0	.0	
HIAL	white-flowered hawkweed	50%	1.0	.0	warm, dry, disturbed sites
HYMO	fringed pinesap	12%	1.0	.0	
IRCH	slender-tubed iris	12%	1.0	.0	
LAP0	leafy peavine	12%	2.0	.0	nitrogen fixer
LIBOL	western twinflower	100%	3.8	1.3	ubiquitous
MOUN2	Indian-pipe	25%	1.5	.7	
MOSI	candyflower	25%	1.0	.0	indicates moist sites
OSCH	mountain sweet-root	12%	1.0	.0	
OXOR	Oregon oxalis	75%	16.8	21.3	productive sites with high precipitation, fertile soil
PLFI2	Sierra-sap	12%	2.0	.0	
POMU	western sword-fern	100%	16.7	23.2	productive sites
PTAQ	bracken	37%	3.0	1.7	indicates disturbance, possible allelopathic to Douglas-fir
PYAP	leafless pyrola	12%	1.0	.0	
PYPI	whitevein pyrola	12%	1.0	.0	
SMRA	western false Solomon's-seal	25%	1.0	.0	
SMST	starry Solomon-plume	37%	1.3	6	generally cool sites
SYRE	snow-queen	25%	1.0	.0	
TITR	foamflower	37%	2.0	1.0	moist environment
TRLA2	western starflower	50%	1.3	.5	mid successional
TROV	white trillium	75%	2.3	1.5	part of the mesic middle indicators
VAHE	white inside-out-flr	37%	1.7	1.2	part of the mesic middle indicators
VIAD	early blue violet	12%	1.0	0	
VIGL	stream violet	25%	1.5	.7	early successional
VIOR2	round-leaved violet	37%	2.0	1.0	mesic sites
	TOTAL HERB	100%	53.5	33.7	
BRPA	Pacific brome	25%	1.0	.0	
FE0C	western fescue	37%	1.0	.0	
FESU	bearded fescue	12%	1.0	0	
JUNCU	rush spp.	12%	1.0	.0	
LUPA	smallflowered woodrush	12%	1.0	.0	
	TOTAL GRASS	100%	1.1	1.0	



**WESTERN HEMLOCK / VINE MAPLE / SNOW BRAMBLE**  
*Tsuga heterophylla / Acer circinatum / Rubus nivalis*  
**TSHE/ACCI/RUNI**

**EXTENT:** TSHE/ACCI/RUNI occurs on the north half of the North Umpqua Ranger District and on Cottage Grove. It may be found in the Willamette or Umpqua Basin. N = 9 plots.

**IDENTIFYING CHARACTERISTICS:** TSHE/ACCI/RUNI is one of the few TSHE associations that generally occur on mid third slope positions. Western hemlock and western redcedar is often found in the overstory. Swordfern and Oregon oxalis are abundant and dominate the herb layer. Vine maple and Pacific yew are characteristically a visible and important part of the shrub layer. TSHE/ACCI/RUNI is somewhat unique in the northwest.

**ABIOTIC ENVIRONMENT:** Parent rock type is similar to the typical Cascade condition, with basalt and andesite the most common parent rock, and pumice and ash less common. All gradations of andesite and basalt, and ash and pumice may be present. More information is presented in the discussion on the Western Cascade and High Cascade Subprovinces.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2643.0	718.0
Aspect (deg)	340.0	47.6
Slope (%)	53.1	28.9
Total soil depth (in)	43.7	12.5
Rooting depth (in)	45.4	9.1
Total basal area (ft <sup>2</sup> /ac)	324.4	92.6

**CLIMATE:** TSHE/ACCI/RUNI is warm and moist. Moisture stress limits growth late in the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.9	2.2
Maximum month temp(F)	83.7	3.1
Mean annual ppt (in)	67.5	3.5
Dry season ppt (in)	8.0	.0

**FOREST FLOOR:** Litter cover is about 15 percent less than the average Cascade condition. Moss

cover is slightly over double the average for the Series. Other variables, gravel, bare ground, rock, and exposed bedrock, are similar to the average condition. The high moss cover is associated with warm, humid conditions.

FOREST FLOOR	MEAN	S D.
Litter (%)	75.4	28.4
Moss (%)	45.2	30.2
Bareground (%)	.6	.7
Gravel (%)	1.9	1.4
Rock (%)	4.6	6.5
Bedrock (%)	.3	1.0

**VEGETATION:** Douglas-fir can regenerate at all seral stages, although it is most efficient in early succession. Western redcedar regeneration increases with stand age. The presence of red alder and cutleaf goldthread, more common on coastal sites, indicates a moderate coastal influence. Incense-cedar indicates the drier sites of the Association. Be cautious, however, incense-cedar is a well adapted generalist. It may be more efficient than other conifers on unusual sites with high water tables, basic parent rock (gabbro, breccia), imbalanced nutrition, and in recent, small canopy openings.

**SILVICULTURE:** Western redcedar, western hemlock, and incense-cedar are the most abundant species present. It is unusual for incense-cedar to attain high cover in the understory. Unusually high covers often indicate parent rock extremes. Rather than basalt or andesite, granite or gabbro may be present. Douglas-fir, white fir, Pacific yew, and red alder grow well, but big-leaf maple may be less competitive. The potential for natural regeneration in TSHE/ACCI/RUNI is moderate. Potential declines as dry site indicators increase, since moisture most limits growth. Red alder, snowbrush, and vine and big-leaf maple are potential competition for crop trees.

**WATERSHED MANAGEMENT:** Stream gradients are usually greater than 40 percent (average slope is 53 percent). Rather than the typical bottom third,

most sites are mid third slope position and may grade into vine maple thickets. Other watershed characteristics are typical of the Series.

**FIRE MANAGEMENT:** TSHE/ACCI/RUNI averages an estimated 68 inches, the highest rainfall for the Series, yet, four of the nine sampled sites (44 percent) had been burned. (I don't know why either).

**RANGE & WILDLIFE MANAGEMENT:** Forb cover averages 85 percent and can be as high as 166 percent. Swordfern, twinflower, and Oregon oxalis are abundant and a variety of other shrubs are common and provide half the cover. Little is known about use and preference by wildlife. *Rubus* species and red huckleberry are the most common browse species. Cover averages 46 percent. Grass cover is low, usually less than 1 percent and is commonly

western fescue. Structure is diverse, thermal and hiding cover is abundant, and range potential is low. Sites are steep, waterless, shallow soiled, and do not produce much forage, even as transitory range.

**RECREATION & VISUAL MANAGEMENT:** TSHE/ACCI/RUNI is similar in climate to TSHE-ACMA/POMU, but it occurs farther up slope on steep terrain. It tends to occur on the lower third of the slope, usually only a few hundred yards or less from streams. Western redcedar and Pacific yew seem to keep stands shaded. Red colors of vine maple dominate the fall view, and trailing blackberry and red huckleberry do provide edible fruit, but yields are limited by shade. Both species need more open conditions to produce. Other characteristics are similar to the Series average.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PSME	Douglas-fir	100%	47.8	17.5	can regenerate at all seral stages regeneration increases with stand age common in overstory
THPL	western redcedar	44%	17.5	16.6	
TSHE	western hemlock	66%	19.2	21.3	
	TOTAL OVERSTORY	100%	68.3	25.5	
ABCO	—CONIFERS— white fir	11%	15.0	.0	grows well may be more efficient than other conifers on unusual sites
CADE3	incense-cedar	11%	30.0	.0	
PSME	Douglas-fir	55%	4.6	.9	grows well
TABR	Pacific yew	66%	12.3	9.2	
THPL	western redcedar	100%	26.9	15.8	wetter sites
TSHE	western hemlock	100%	62.2	25.4	highly productive
	—HARDWOODS—				
ACCI	vine maple	100%	20.1	9.2	very competitive in plantations
ACGL	Douglas maple	22%	2.0	1.4	
ACMA	big-leaf maple	11%	1.0	.0	potential competition in plantations
ALRU	red alder	11%	2.0	.0	
CACH	golden chinquapin	55%	3.2	2.0	highly competitive in plantations, nitrogen fixer rocky sites or ridgetops
	TOTAL UNDERSTORY	100%	127.6	33.3	
BENE	dwarf Oregongrape	100%	19.3	18.2	deep, fertile soils
CHME	little prince's-pine	22%	1.0	.0	dry site indicator
CHUM	common prince's-pine	44%	3.5	3.1	
COCOC	California hazel	11%	2.0	.0	provides deer browse
GASH	salal	77%	8.9	8.3	warm, dry, well-drained sites
OECE	Indian plum	11%	1.0	.0	
RHPU	cascara	11%	1.0	0	provides deer browse, laxative properties in bark
RHMA	Pacific rhododendron	11%	2.0	.0	
ROGY	baldhip rose	22%	2.0	1.4	hips contain high levels of vitamin C
RUNI	snow bramble	100%	6.7	8.4	provides food for birds
RUPA	thimbleberry	11%	1.0	0	provides food for birds
RUUR	Pacific blackberry	100%	1.8	1.0	excellent deer browse
VAME	thin-leaved huckleberry	11%	1.0	0	excellent berry picking, provides food for bears
VAPA	red huckleberry	77%	8.1	10.4	good for berry picking
WHMO	whippievine	22%	4.0	1.4	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	45.1	27.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	55%	2.0	1.0	moist sites, deep, well-drained soils
ADBI	trail-plant, pathfinder	11%	1.0	.0	common
ADPE	northern maidenhair	33%	1.7	.6	wet sites
ANDE	threeleaf anemone	55%	2.0	1.7	common, mesic sites
ASCA3	western wild ginger	11%	1.0	.0	occurs on wetter sites
ASTR	maidenhair spleenwort	11%	1.0	.0	moist site indicator
BLSP	deer-fern	22%	2.0	1.4	moist site indicator
COLA	cutleaf goldthread	55%	6.2	8.0	
COMA3	spotted coral-root	22%	1.0	.0	
DIHOO	Oregon fairybell	66%	1.0	.0	
GAAP	catchweed bedstraw	88%	1.4	.5	
GAOR	Oregon bedstraw	11%	1.0	.0	
GOOB	rattlesnake-plantain	88%	2.0	1.4	
HAL	white-flowered hawkweed	55%	2.2	1.6	warm, dry, disturbed sites
LAPO	leafy peavine	11%	1.0	0	nitrogen fixer
LIBOL	western twinflower	77%	27.4	29.1	ubiquitous
LICA3	northwest listera	22%	1.0	.0	
LUCA2	tailcup lupine	11%	1.0	.0	possible nitrogen fixer
MITEL		11%	1.0	.0	
MOUN2	Indian-pipe	44%	1.0	.0	
OXOR	Oregon oxalis	100%	19.8	24.4	productive sites with high precipitation, fertile soil
PERA	leafy lousewort	11%	2.0	.0	
PEWI	Wilcox's penstemon	11%	1.0	.0	
POMU	western sword-fern	100%	24.0	26.6	productive sites
PTAN	woodland pinedrops	11%	1.0	.0	
PYPI	whitevein pyrola	22%	1.0	.0	
SEBO	Bolander's groundsel	11%	1.0	.0	
SMRA	western false Solomon's-seal	33%	1.0	.0	
SMST	starry Solomon-plume	22%	8.0	9.9	generally cool sites
TITR	foamflower	77%	2.1	1.3	moist environment
TRLA2	western starflower	22%	1.5	.7	mid successional
TROV	white trillium	77%	1.0	.0	part of the middle mesic indicators
VAHE	white inside-out-flr	44%	2.0	2.0	part of the middle mesic indicators
VIAM	American vetch	11%	1.0	.0	possible nitrogen fixer
VIOR2	round-leaved violet	55%	1.0	.0	mesic sites
WISE	redwoods violet	22%	1.5	.7	
	TOTAL HERB	100%	85.9	53.3	
FESTU	fescue spp.	22%	1.0	.0	
FEOC	western fescue	22%	1.0	.0	
FESU	bearded fescue	22%	1.0	.0	
	TOTAL GRASS	100%	.8	.7	

**WESTERN HEMLOCK - WESTERN REDCEDAR / OREGON OXALIS**  
*Tsuga heterophylla* - *Thuja plicata* / *Oxalis oregana*  
**TSHE-THPL/OXOR**

**EXTENT:** TSHE-THPL/OXOR occurs on the North Umpqua and Tiller Ranger Districts in the Western Cascade and Klamath Subprovinces. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** Typically Douglas-fir dominates the overstory with an occasional white fir, but incense-cedar is absent. The understory is composed of western hemlock, western redcedar, white fir and Douglas-fir. The shrub and herb layer usually is less dense than the average TSHE association.

**ABIOTIC ENVIRONMENT:** Parent rock is basalt or andesite with few sites on pumice or ash. The former tend to produce fertile, deep soils. The ash and pumice soils are usually shallow, sterile, and fragile. Refer to the discussion of the High Cascade Province. Elevation is slightly lower than the average Cascade site, an advantage for western redcedar, which prefers warm moist climates. Slopes are about 10 percent higher, but aspects are typically northeast.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3249.0	958.0
Aspect (deg)	46.2	69.2
Slope (%)	40.0	27.7
Total soil depth (in)	42.5	7.8
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	268.6	81.5

**CLIMATE:** TSHE-THPL/OXOR is a typically moderate TSHE Association. Annual precipitation is slightly higher than the average association, but summer rates and the temperature regime are about average. Moisture stress limits growth late in the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.5	2.6
Maximum month temp (F)	81.4	3.8
Mean annual ppt (in)	63.0	4.5
Dry season ppt (in)	8.2	.4

**FOREST FLOOR:** Forest floor conditions are typical of the Western Hemlock Series where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages in the low to mid twenties.

FOREST FLOOR	MEAN	S.D.
Litter (%)	93.3	9.2
Moss (%)	26.1	27.6
Bareground (%)	.1	.4
Gravel (%)	2.0	4.9
Rock (%)	1.6	2.7
Bedrock (%)	.7	1.9

**VEGETATION:** TSHE-THPL/OXOR generally is a warm, moist association. However, sites with thin-leaved huckleberry, silver fir, and leafy lousewort indicate the coldest sites of the Series. Snowberry and bracken fern, like Douglas-fir, often indicate recent disturbance. They tend to decrease with increasing time since disturbance.

**SILVICULTURE:** Western redcedar, western hemlock, and Douglas-fir are the most productive species, followed by white fir, incense-cedar, silver fir, Pacific yew, and golden chinquapin. Potential for using natural regeneration is high. Competition from shrubs and hardwoods is usually light.

**WATERSHED MANAGEMENT:** TSHE-THPL/OXOR is typical of the Series associations except for generally higher ease of regenerating disturbed sites. Western redcedar is common on lower third slope positions and benches where summer humidity is high.

**FIRE MANAGEMENT:** Reviewing the Series Summary for general information will provide what little is known about the fire climate and regime of TSHE-THPL/OXOR which is a typical TSHE association. Approximately 14 percent of sampled sites were burned.

**RANGE & WILDLIFE MANAGEMENT:** Although forage cover averages 58 percent, it can range from 6 to 152 percent. Shrub cover is similarly inconsistent; it may range from 2 to 111 percent. Neither shrub nor herb cover is related to tree cover. High herb cover may be found under dense or light canopies. This lack of relationship holds for most Cascade Series, except where dense cover of salal is found. Species composition is also inconsistent, there is wide variability among sites. Conditions range from high cover of Pacific rhododendron to low scatter cover of dwarf Oregon grape. Sites are often found near water courses and the slope varies greatly.

Variation in structure is high and habitat for birds and small mammals is abundant.

**RECREATION & VISUAL MANAGEMENT:** TSHE-THPL/OXOR occurs in low elevation, cool bottoms, occasionally the lower third of the slope, supporting a thick canopy of western hemlock, western redcedar, and white fir. Occasionally stands are open, however, some support thick (80 percent cover) Pacific rhododendron. Typically, vine maple adds fall color. Other visual and recreation characteristics follow the Series average.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	14%	1.0	.0	indicates the coldest sites of the Series
ABCO	white fir	42%	6.7	2.9	moderately productive in the Association
PSME	Douglas-fir	100%	45.7	13.0	high productivity in this Association
THPL	western redcedar	42%	11.7	7.6	high productivity in this Association
TSHE	western hemlock	71%	13.4	7.1	high productivity in the Association
	TOTAL OVERSTORY	100%	63.3	20.6	
	—CONIFERS—				
ABCO	white fir	71%	12.4	12.8	on coldest sites
PSME	Douglas-fir	71%	10.2	6.9	indicates past disturbance
TABR	Pacific yew	14%	5.0	.0	found in microsites with high humidity
THPL	western redcedar	100%	18.6	16.7	indicates wetter sites
TSHE	western hemlock	100%	43.6	30.9	high productivity
	—HARDWOODS—				
ACCI	vine maple	85%	8.8	4.5	provides nice color in the fall
CACH	golden chinquapin	14%	2.0	.0	indicates shallow, rocky soils
	TOTAL UNDERSTORY	100%	86.9	23.2	
AMAL	western serviceberry	14%	1.0	.0	
BENE	dwarf Oregongrape	100%	3.6	1.4	deep, fertile soils
CHME	little prince's-pine	28%	1.0	.0	
CHUM	common prince's-pine	14%	2.0	.0	dry site indicator
CONU	Pacific dogwood	14%	10.0	.0	beautiful flowers
GASH	salal	28%	11.0	12.7	warm, dry, well-drained sites
RHMA	Pacific rhododendron	28%	56.5	58.7	possible vegetation management problem
RILA	swamp gooseberry	14%	1.0	.0	provides food for birds
RISA	red currant	14%	1.0	.0	provides food for birds
ROGY	baldhip rose	28%	1.0	.0	hips contain high levels of vitamin C
RULA	dwarf bramble	14%	4.0	.0	provides food for birds
RUPA	thimbleberry	14%	1.0	.0	provides food for birds
RUUR	Pacific blackberry	71%	1.8	.8	excellent deer browse
SYMO	creeping snowberry	28%	1.0	.0	indicates disturbance
VAME	thin-leaved huckleberry	42%	2.7	2.1	provides food for bears
VAPA	red huckleberry	57%	1.8	1.0	provides food for birds
WHMO	whipplevine	28%	1.5	.7	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	30.4	38.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	28%	6.5	4.9	moist sites, deep, well-drained soil
ADBI	trail-plant, pathfinder	28%	1.0	.0	common
ADPE	northern maidenhair	14%	2.0	0	wet site indicator
ANDE	threeleaf anemone	42%	1.7	1.2	common, mesic sites
ASCA3	western wild ginger	28%	1.0	.0	occurs on wetter sites
ASTR	maidenhair spleenwort	14%	1.0	.0	moist site indicator
BLSP	deer-fern	14%	2.0	.0	wet site indicator
CASC2	rough harebell	28%	3.0	2.8	
CLUN	queen's cup	42%	1.7	.6	indicates cool, moist sites
COLA	cutleaf goldthread	57%	2.8	1.7	may suggest a marine influence
CORAL	coral-root	14%	1.0	.0	
COST2	hooded coral-root	14%	1.0	0	
DIFO	Pacific bleedingheart	14%	3.0	.0	
DIHOO	Oregon fairybell	42%	1.0	.0	
FRVEB	woods strawberry	14%	2.0	.0	quite tasty
GAAP	catchweed bedstraw	42%	1.0	.0	
GOOB	rattlesnake-plantain	42%	1.7	.6	
HIAL	white-flowered hawkweed	42%	1.0	.0	warm, dry, disturbed sites
LIBOL	western twinflower	71%	18.2	10.3	found everywhere
MOSI	candyflower	14%	3.0	.0	moist site indicator
OSCH	mountain sweet-root	14%	1.0	.0	
OXOR	Oregon oxalis	100%	12.7	13.7	productive sites with high precipitation, fertile soil
PERA	leafy lousewort	14%	15.0	.0	
POMU	western sword-fern	85%	14.8	27.2	used by mountain beaver to line burrows
PTAQ	bracken	42%	1.3	.6	aggressive competitor in plantations, may be allelopathic to Douglas-fir
PYPI	whitevein pyrola	28%	1.0	.0	
PYSE	one-sided pyrola	14%	1.0	.0	indicates cool environment
SMRA	western false Solomon's-seal	14%	1.0	.0	
SMST	starry Solomon-plume	28%	1.0	.0	generally cool sites
SYRE	snow-queen	14%	3.0	.0	
TITR	foamflower	71%	2.8	3.0	moist environment
TRLA2	western starflower	57%	1.0	0	mid successional
TROV	white trillium	71%	1.0	0	moist sites, mid successional
VAHE	white inside-out-flr	28%	1.0	.0	warm, moist sites, lower elevations
VIGL	stream violet	14%	2.0	.0	early successional
VIOR2	round-leaved violet	85%	1.2	.4	mesic sites
	TOTAL HERB	100%	58.1	47.5	
FEOC	western fescue	28%	1.0	.0	
	TOTAL GRASS	100%	.3	5	



**WESTERN HEMLOCK / VINE MAPLE / OREGON OXALIS**  
*Tsuga heterophylla* / *Acer circinatum* / *Oxalis oraganum*  
**TSHE/ACCI/OXOR**

**EXTENT:** TSHE/ACCI/OXOR commonly occurs on the North Umpqua Ranger District. It likely occurs elsewhere in the Western Cascade Sub-province. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** Douglas-fir and western hemlock dominate the overstory, while western hemlock, white fir, Douglas-fir, and rarely, incense-cedar are common in the understory. Thin-leaved huckleberry is the common shrub, and pathfinder, goldentthread, and fairy bells are the more visible herbs. This association is colder than TSHE/ACCI/GASH found on the Siuslaw National Forest.

**ABIOTIC ENVIRONMENT:** Parent rock is basalt and andesite, the most common parent rock types, and granite, which only occurs sporadically on the Umpqua National Forest. Basalts are generally fertile, stable and lack operational constraints. Granite, on the other hand, often is less fertile, less productive, and more subject to erosion. The average elevation for TSHE/ACCI/OXOR is higher than the Series average. Otherwise, abiotic variables are similar to the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4252.0	114.0
Aspect (deg)	241.7	74.4
Slope (%)	27.7	23.4
Total soil depth (in)	41.3	10.4
Rooting depth (in)	44.2	7.1
Total basal area (ft <sup>2</sup> /ac)	390.0	50.3

**CLIMATE:** Temperatures are lower than all but the TSHE-ABAM/VAME Association. Rainfall amounts are slightly higher than the average TSHE site, but not significantly so. Unlike most TSHE associations, temperature can limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.1	.5
Maximum month temp (F)	77.5	.6
Mean annual ppt (in)	61.2	2.5
Dry season ppt (in)	8.3	5

**FOREST FLOOR:** Forest floor conditions are similar to Cascade Province and Western Hemlock Series averages, except for moss cover, where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss cover (3 percent) is much lower than average, where temperatures limit growth.

FOREST FLOOR	MEAN	S.D.
Litter (%)	85.2	23.5
Moss (%)	3.0	4.7
Bareground (%)	2.0	2.4
Gravel (%)	1.0	.8
Rock (%)	.8	1.0
Bedrock (%)	5	1.0

**VEGETATION:** TSHE/ACCI/OXOR tends to favor species requiring cool environments. However, there is enough variation within the Association that incense-cedar, whipplevine, creambush oceanspray, and snowberry may be found together, indicating the warmest sites of the Association. As usual, western white pine indicates the coolest sites.

**SILVICULTURE:** Vine maple is productive, easy to regenerate, visually pleasing from afar, and provides diversity, but markets are likely to remain low. Douglas-fir, western hemlock, and western white pine (rust resistant) are recommended for regeneration. However, white fir and incense-cedar are certainly productive options. Pacific madrone is associated with disturbed sites, and is near the limits of its range on cool sites. It is an important early seral species and will remain part of most stands. Incense-cedar is the most versatile species and can

be used in disease pockets and wet and dry microsites. Potential for natural regeneration is moderate. Site preparation to reduce vine maple cover will increase planting efficiency, reduce competition for light and water, and result in higher conifer density. Snowbrush competition may reduce diameter growth on some sites. And less often, high cover of thin-leaved huckleberry may be a barrier to planting. On such sites, frost may affect survival.

**WATERSHED MANAGEMENT:** Snow accumulation is higher than the average association. Slopes average about 3000 feet in length, about 100 feet longer than average, and most sites tend to occur on the upper third slope position.

**FIRE MANAGEMENT:** Low temperatures are characteristic of TSHE/ACCI/OXOR, but it is an excellent fuel producer. Fire occurrence is 50 percent, high for the Series. Refer to the Series Summary for a general discussion of the TSHE fire regime.

**RANGE & WILDLIFE MANAGEMENT:** Some browse and forage is available. Forb cover aver-

ages 108 percent, and can be as high as 183 percent. Shrubs, mainly thin-leaved huckleberry, vine maple, and blackberry, average about 40 percent cover. Snow accumulation at high elevation limits winter range potential. Stand structure, including the forest floor is variable, inclusions of rock scree may occasionally be found. *Hemitomes congestum*, once considered sensitive, occurs in the Association.

**RECREATION & VISUAL MANAGEMENT:** TSHE/ACCI/OXOR tends to occur near ridge tops and the upper third of major ridges. Slope lengths are long (usually over a quarter mile) and sites are far from running water. Although it is typical forest, it is sometimes found adjacent to scree slopes dominated by vine or Douglas maple. These thickets provide visual contrast, outstanding fall vistas, as well as openings or viewing opportunities. Thin-leaved huckleberry is common and can produce a good crop of berries, particularly in the transition from forest to scree.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	20.0	14.1	moderately productive in this Association
PIMO	western white pine	50%	10.0	7.1	good regeneration option
PSME	Douglas-fir	100%	55.0	10.8	pioneer after disturbance
TSHE	western hemlock	75%	11.7	7.6	highly productive
	TOTAL OVERSTORY	100%	78.7	8.5	
ABCO	—CONIFERS—				
CADE3	white fir	75%	6.3	4.7	common in understory
	incense-cedar	25%	2.0	.0	versatile, can be planted in disease pockets and wet or dry sites
PIMO	western white pine	25%	1.0	.0	good regeneration option
PSME	Douglas-fir	75%	1.0	.0	good regeneration option
TABR	Pacific yew	25%	3.0	.0	bark contains a cancer inhibiting chemical
TSHE	western hemlock	100%	24.7	15.5	highly productive in this Association
	—HARDWOODS—				
ACCI	vine maple	100%	56.2	26.9	will be a vegetation management problem
	TOTAL OVERSTORY	100%	88.0	24.8	
AMAL	western serviceberry	25%	1.0	.0	good deer browse
BENE	dwarf Oregongrape	100%	7.0	5.0	deep, fertile soils
CHME	little prince's-pine	50%	1.0	.0	
CHUM	common prince's-pine	75%	7.7	10.7	dry site indicator
HODI	creambush ocean-spray	25%	1.0	.0	good deer browse
PHMA	Pacific rhododendron	75%	22.0	33.0	possible competitor in plantations
ROGY	baldhip rose	100%	2.8	1.0	hips contain high levels of vitamin C
RULA	dwarf bramble	50%	4.5	3.5	provides food for birds
RULE	black raspberry	50%	1.0	.0	provides food for birds
RUNI	snow bramble	75%	1.7	.6	provides food for birds
RUPA	thimbleberry	25%	1.0	.0	provides food for birds
RUUR	Pacific blackberry	75%	2.7	2.1	excellent deer browse
SYMO	creeping snowberry	25%	1.0	0	disturbance indicator
VAME	thin-leaved huckleberry	100%	1.5	6	excellent for berry picking, provides food for bears
VAPA	red huckleberry	25%	1.0	0	provides food for birds
WHMO	whipplevine	25%	1.0	.0	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	41.5	33.4	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACMI	common yarrow	25%	1.0	.0	often increases with site disturbance and overgrazing
ACTR	vanilla leaf	75%	31.7	20.2	moist sites, deep, well-drained soil
ADBI	trail-plant, pathfinder	100%	4.3	3.9	common
ANDE	threeleaf anemone	75%	2.0	1.0	common, mesic sites
ANLY2	Lyal anemone	25%	1.0	.0	
ARMA3	bigleaf sandwort	25%	1.0	.0	
ASCA3	western wild ginger	25%	1.0	.0	occurs on wetter sites
CASC2	rough harebell	100%	1.0	.0	
CLUN	queen's cup	75%	1.7	1.2	indicates cool, moist sites
CONY	night-blooming morning-glory	25%	1.0	.0	
COLA	cutleaf goldthread	100%	2.0	.8	
COMA3	spotted coral-root	50%	1.0	.0	
COME	Pacific coral-root	25%	1.0	0	
DIHOO	Oregon fairybell	75%	2.3	2.3	
EPMI	small-fl'd willow-herb	25%	1.0	.0	
FRVEB	woods strawberry	25%	3.0	.0	quite tasty
GAAP	catchweed bedstraw	75%	1.0	.0	
GAOR	Oregon bedstraw	25%	1.0	.0	
GATR	fragrant bedstraw	25%	1.0	.0	
GOOB	rattlesnake-plantain	100%	1.3	.5	
HECO	gnome-plant	25%	1.0	.0	
HAL	white-flowered hawkweed	100%	1.0	.0	warm, dry, disturbed sites
LIBOL	western twinflower	100%	3.5	4.4	found everywhere
LICA3	northwest listera	50%	1.0	.0	
MOUN2	Indian-pipe	50%	1.0	.0	
MOSI	candyflower	50%	1.5	.7	moist site indicator
OSCH	mountain sweet-root	50%	1.0	.0	
OXOR	Oregon oxalis	100%	43.7	22.5	productive sites with high precipitation and fertile soil
PERA	leafy lousewort	25%	1.0	.0	
PECA3	Cardwell's penstemon	25%	1.0	.0	
PEOV	broad-leaved penstemon	50%	1.5	.7	
PHAD	woodland phlox	25%	1.0	.0	
POMU	western sword-fern	75%	2.0	1.7	used by mountain beaver to line burrows
PTAN	woodland pinedrops	25%	1.0	.0	
PYPI	whitevein pyrola	75%	1.3	.6	
PYSE	one-sided pyrola	50%	1.0	0	cool environments
SEBO	Bolander's groundsel	25%	1.0	.0	
SMST	starry Solomon-plume	100%	5.0	6.7	generally cool sites
SYRE	snow-queen	25%	1.0	.0	
TITR	foamflower	75%	2.3	.6	moist environments
TRLA2	western starflower	25%	1.0	.0	moderately dry to moist sites, disturbed sites, mid successional
TROV	white trillium	75%	1.0	0	moist sites, mid successional
VAHE	white inside-out-flr	75%	2.3	2.3	warm, moist sites, lower elevations
VIGL	stream violet	25%	2.0	.0	early successional
VIOR2	round-leaved violet	50%	2.0	.0	mesic sites
	TOTAL HERB	100%	108.2	50.5	
BRPA	Pacific brome	25%	1.0	.0	
BRVU	Columbia brome	25%	1.0	0	
FEOC	western fescue	75%	1.0	0	
FESU	bearded fescue	25%	2.0	0	
LUPA	smallflowered woodrush	25%	1.0	.0	
MESU	Alaska oniongrass	25%	1.0	.0	
	TOTAL GRASS	100%	2.5	1.7	

WESTERN HEMLOCK / SALAL / OREGON OXALIS  
*Tsuga heterophylla* / *Gaultheria shallon* / *Oxalis oregana*  
**TSHE/GASH/OXOR**

**EXTENT:** TSHE/GASH/OXOR occurs in the Western Cascade Subprovince on the Tiller, North Umpqua, and Cottage Grove Ranger Districts. It may occur at lower elevations on the Diamond Lake Ranger District or on moist sites on the Prospect Ranger District of the Rogue River National Forest. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** The combination of Douglas-fir and western hemlock usually dominate the tree layer with little else present. Salal and vine maple are usually common and the herb layer is about average for the Series. Combinations of western hemlock, salal, Oregon oxalis, and dwarf Oregongrape are common in the Northwest. The TSHE/GASH association of the Willamette National Forest is most similar.

**ABIOTIC ENVIRONMENT:** Parent rock is basalt, the most common parent rock in the Cascades. Gabbro occasionally supports the Association. Soils are deep, fertile, and stable. Although slopes are steep, there are no known operational constraints. Elevations average about 1,000 feet lower than the Series average and the temperature regime is correspondingly warmer.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2372.0	110.0
Aspect (deg)	353.1	29.3
Slope (%)	49.5	19.8
Total soil depth (in)	44.4	11.2
Rooting depth (in)	45.4	9.3
Total basal area (ft <sup>2</sup> /ac)	235.0	80.6

**CLIMATE:** Temperatures are high, as often indicated by high salal cover. Precipitation is slightly below the Series average. Sites are warm, but the forest floor is cool and damp. Harvest and site preparation will profoundly affect the climate near the ground. Moisture is the most limiting factor affecting survival and growth.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	48.5	.3
Maximum month temp (F)	84.7	5
Mean annual ppt (in)	60.0	.0
Dry season ppt (in)	8.0	.0

**FOREST FLOOR:** Litter cover is about 40 percent lower than the Series average. Moss cover is about double the Series average. High decomposition rates associated with the warm, moist conditions, may be partly responsible for the lack of litter. Steep slopes found on most sites may also play a part. The amount of exposed soil (bareground) and bedrock are also high compared to the typical TSHE site. Operations affecting the soil surface may need special attention.

FOREST FLOOR	MEAN	S.D.
Litter (%)	52.5	40.9
Moss (%)	51.2	25.9
Bareground (%)	18.0	34.7
Gravel (%)	2.8	2.6
Rock (%)	6.5	9.3
Bedrock (%)	10.0	20.0

**VEGETATION:** Associations or sites with high cover of salal are usually the warmest and driest of the Series. TSHE/GASH/OXOR is slightly drier than the average association with incense-cedar and sugar pine growing on the warmest sites. As in most associations in the Series, there are species (bigleaf maple for example) that indicate a climate moderated by summer marine air (summer low clouds that burn off during the day). Oxalis indicates the cool, moist microsites.

**SILVICULTURE:** Western hemlock, Douglas-fir, sugar pine, and incense-cedar are the most productive species. Western hemlock survival will decrease with increasing intensity of disturbance. Douglas-fir is most appropriate following clear-cutting and burning, but less modification of the soil surface maintains long-term site productivity. Ponderosa pine and Pacific madrone are appropriate on

burned sites. Stocking level control will likely be needed if ponderosa pine constitutes over a third of the stand basal area. Intertree competition will be severe and diameter growth rates will suffer, since ponderosa pine is particularly sensitive to high densities. Big-leaf maple and golden chinquapin can be used for revegetation. Maple stabilizes barren banks and slopes, particularly on shaded aspects, and chinquapin can tolerate exposed ridgetops with shallow, infertile soils and rockpiles. Potential for natural regeneration is relatively low. Burned sites with heavy site preparation will require some artificial planting. Vegetation management may be needed. Pacific madrone on the drier sites and the maples on the moist sites are the most likely target species.

**WATERSHED MANAGEMENT:** TSHE/GASH/OXOR is a typical TSHE association. The Series Summary describes the general characteristics of the associations.

**FIRE MANAGEMENT:** Salal cover usually indicates relatively dry conditions, as in this case. Sites are estimated to have high average annual tempera-

tures, but the amount of litter found on most sites was below the Series average. Thus, fuel production may be low. Although fire occurrence (25 percent) is below the Series average, it is a typical Association.

**RANGE & WILDLIFE MANAGEMENT:** TSHE/GASH/OXOR produces high cover of forbs in most stands. Average cover is 77 percent and low for the Association is 46 percent. There are a variety of herbs, but swordfern, Oregon oxalis, and twinflower are the most common. Salal and dwarf Oregon grape provide the majority of shrub cover, but vine maple, big-leaf maple, red huckleberry, and thin-leaved huckleberry are often common. Low and high shrub cover is abundant. Browse is not abundant.

**RECREATION & VISUAL MANAGEMENT:** Most sites are typical of the average TSHE association, relatively cool, moist and floristically rich, with no unusual or outstanding features. Salal, common and sometimes thick, can rob the joy from off-trail hiking.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PILA	sugar pine	25%	5.0	.0	more seral in behavior, productive in this association most appropriate after clearcutting survival will decrease with increasing intensity of disturbance
PSME	Douglas-fir	100%	51.2	18.9	
TSHE	western hemlock	75%	20.0	13.2	
	TOTAL OVERSTORY	100%	67.5	14.4	
CADE3	—CONIFERS— incense-cedar	50%	9.0	1.4	tolerates soil and climatic extremes more seral in behavior pioneer after disturbance bark contains a chemical that inhibits cancer growth moderately productive on this site
PILA	sugar pine	25%	1.0	.0	
PSME	Douglas-fir	75%	4.3	1.2	
TABR	Pacific yew	25%	1.0	.0	
TSHE	western hemlock	100%	46.2	27.8	may be a vegetation management problem aggressive competitor in conifer plantations tolerates exposed ridgetops with shallow, infertile soils preferred deer browse
	—HARDWOODS— vine maple	75%	26.7	7.6	
ACMA	big-leaf maple	75%	8.3	6.1	
CACH	golden chinquapin	25%	5.0	.0	
PREM	bittercherry	25%	2.0	.0	deep, fertile soils
	TOTAL UNDERSTORY	100%	82.5	28.4	
BENE	dwarf Oregongrape	100%	19.7	16.5	
CHME	little prince's-pine	25%	1.0	.0	
CHUM	common prince's-pine	25%	1.0	.0	dry site indicator beautiful spring flowers provides deer browse
CONU	Pacific dogwood	50%	7.5	3.5	
COCOC	California hazel	25%	6.0	.0	
GASH	salal	100%	42.0	33.7	
HODI	creambush ocean-spray	50%	2.5	.7	warm and dry, well-drained sites provides deer browse may be a vegetation management problem dry, hot sites with well-drained soils
RHMA	Pacific rhododendron	25%	3.0	.0	
RHDI	poison oak	25%	1.0	.0	
ROGY	baldhip rose	25%	1.0	.0	
RUPA	thimbleberry	25%	6.0	.0	hips contain high levels of vitamin C provides food for birds excellent deer browse provides edible berries
RUUR	Pacific blackberry	75%	3.0	1.0	
VAPA	red huckleberry	75%	3.0	2.6	
WHMO	whipplevine	25%	1.0	0	
	TOTAL SHRUB	100%	76.2	35.7	warm, dry sites at low elevations, often rocky

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	75%	1.7	1.2	moist sites, deep, well-drained soil
ADBI	trail-plant, pathfinder	50%	2.5	.7	common
ADCA	Venus-hair fern	25%	1.0	.0	wet sites
ANDE	threeleaf anemone	25%	1.0	.0	common, mesic sites
CASC2	rough harebell	25%	1.0	.0	
COLA	cutleaf goldthread	50%	3.0	2.8	
DIHOO	Oregon fairybell	50%	1.0	.0	
EPAN	fireweed	25%	1.0	.0	abundant the first year after burning in harvested units
GAAP	catchweed bedstraw	25%	1.0	.0	
GAOR	Oregon bedstraw	50%	1.0	.0	
GOOB	rattlesnake-plantain	50%	1.0	.0	
LIBOL	western twinflower	75%	3.7	1.2	found everywhere
LICA3	northwest listera	25%	1.0	.0	
MOUN2	Indian-pipe	25%	1.0	.0	
MOSI	candyflower	25%	1.0	.0	moist site indicator
OXOR	Oregon oxalis	100%	29.7	20.0	productive sites with high precipitation and fertile soil
POMU	western sword-fern	100%	30.2	26.6	generally productive sites
PTAQ	bracken	50%	4.5	3.5	aggressive competitor after site disturbance
PYPI	whitevein pyrola	25%	3.0	.0	
TITR	foamflower	25%	1.0	.0	moist environments
TRLA2	western starflower	50%	2.0	1.4	moderately dry to moist sites
TROV	white trillium	25%	2.0	.0	moist sites, mid successional
VAHE	white inside-out-flr	25%	2.0	.0	warm, moist sites, lower elevations
VIOR2	round-leaved violet	50%	4.0	4.2	mesic sites
	TOTAL HERB	100%	77.5	29.9	
BRER	meadow brome	25%	2.0	.0	
FESTU	fescue spp.	25%	1.0	.0	
FEOC	western fescue	25%	1.0	.0	
	TOTAL HERB	100%	1.3	.5	



**WESTERN HEMLOCK / DWARF OREGONGRAPE / OREGON OXALIS (SWO)**  
*Tsuga heterophylla* / *Berberis nervosa* / *Oxalis oregana* (SWO)  
**TSHE/BENE/OXOR (SWO)**

**EXTENT:** TSHE/BENE/OXOR (SWO) occurs in the Western Cascade Subprovince in the Umpqua and Willamette Basins. It occurs sporadically on the Cottage Grove and North Umpqua Ranger Districts. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** Douglas-fir dominates the overstory with an occasional western hemlock (some sites). The understory tree layer is more diverse with western hemlock dominating, but white fir, Douglas-fir, or Pacific yew is an occasional associate. This association is similar to TSHE/BENE/OXOR described on the Willamette National Forest (Hemstrom et al. 1987).

**ABIOTIC ENVIRONMENT:** Parent rock is usually basalt, rhyolite, or a mix of igneous rocks. Soils, the deepest of the Series, are productive and stable, without operational constraints. Steeper sites on rhyolite are more erosive and less resilient than corresponding basaltic sites.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3405.0	433.0
Aspect (deg)	288.1	94.4
Slope (%)	47.2	17.8
Total soil depth (in)	50.0	.0
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	325.0	34.2

**CLIMATE:** TSHE/BENE/OXOR (SWO) has a typical moderate Cascade climate. Temperature does not limit Douglas-fir growth, and trees recover overnight from afternoon moisture stress until late summer. Moisture is the first environmental factor during the growing season to limit growth.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.3	1.2
Maximum month temp(F)	80.8	1.8
Mean annual ppt (in)	60.0	.0
Dry season ppt (in)	8.0	.0

**FOREST FLOOR:** Litter and moss cover are lower than the average TSHE site, while exposed bedrock is more common. Rates of incorporation and decomposition of organic matter are about average for the Series, TSHE/BENE/OXOR (SWO) is in the middle of the Cascade environmental grid.

FOREST FLOOR	MEAN	S.D.
Litter (%)	72.5	38.4
Moss (%)	13.5	15.6
Bareground (%)	.5	1.0
Gravel (%)	2.0	2.2
Rock (%)	5.0	4.1
Bedrock (%)	5.5	9.7

**VEGETATION:** TSHE/BENE/OXOR (SWO) is a typical Western Hemlock Association. The extremely warm sites support whipplevine, cream-bush oceanspray, hairy honeysuckle, or some combination of the three. Rattlesnake-plantain, one of the most constant species in the Northwest, is always present. If its not found during your initial search, keep looking. It indicates you are still in the woods and are not lost. It is a little known fact that the each leaf is imprinted with a map to the nearest Safeway (most botanists believe the markings are just mottling).

**SILVICULTURE:** Typically, western hemlock is the most efficient species in late seral stages and Douglas-fir dominates early stages. Each species has an appropriate microsite where it excels in exploiting the site's resources. The microclimate on most sites is cooler than TSHE/GASH/OXOR, and the potential for increased growth and survival of naturals is much higher. Sugar pine, white fir, and incense-cedar, although present in some stands, seem to be much less efficient than Douglas-fir and western hemlock. The need for controlling competing species is low.

**WATERSHED MANAGEMENT:** The average slope and stream gradient is slightly steeper than the typical association. Slopes average 47 percent and are usually upper to mid third position. For information on the typical association, see the Series Summary.

**FIRE MANAGEMENT:** TSHE/BENE/OXOR (SWO) is typical of the Series, except for the amount of litter. Amounts are about 16 percent less than the average association. Evidence of fire was not found on any of the four sampled sites.

**RANGE & WILDLIFE MANAGEMENT:** Forage cover for both herbs and shrubs is low. Herb cover is rarely over 50 percent and averages 23 percent. Shrub cover (27 percent average) is often less than

10 percent. The understory is relatively open and often lacks the vertical structure associated with the Series. Sensitive species are not known to occur in TSHE/BENE/OXOR (SWO).

**RECREATION & VISUAL MANAGEMENT:** Visual and recreational character are similar to the average description given for the Series. Sites are typical forest, relatively cool, moist and floristically rich, with no unusual or outstanding features.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PSME	Douglas-fir	100%	55.0	12.2	dominates early stages
TSHE	western hemlock	25%	20.0	.0	most efficient species in late seral stages
	TOTAL OVERSTORY	100%	60.0	13.5	
	—CONIFERS—				
ABCO	white fir	25%	3.0	.0	less efficient than western hemlock or Douglas-fir
PSME	Douglas-fir	50%	6.0	1.4	good for regeneration
TABR	Pacific yew	50%	4.0	2.8	may be planted in humid sites
TSHE	western hemlock	100%	63.7	35.4	good producer
	—HARDWOODS—				
ACCI	vine maple	100%	21.2	11.1	provides nice fall color
	TOTAL UNDERSTORY	100%	90.7	37.0	
BENE	dwarf Oregongrape	100%	6.5	4.4	deep, fertile soils
CHME	little prince's-pine	25%	1.0	.0	
COCOC	California hazel	25%	5.0	.0	provides deer browse
GAOV	slender salal	25%	15.0	.0	cool, moist areas, mid to upper elevations
GASH	salal	50%	1.5	.7	warm and dry, well-drained sites
HODI	creambush ocean-spray	25%	10.0	.0	provides deer browse
LOCI	trumpet honeysuckle	25%	1.0	.0	
RHMA	Pacific rhododendron	25%	2.0	.0	nice spring flowers
ROGY	baldhip rose	50%	3.0	2.8	hips contain high levels of vitamin C
RUNI	snow bramble	75%	1.7	1.2	provides food for birds
RUPA	thimbleberry	25%	1.0	.0	has edible berries
RUUR	Pacific blackberry	25%	3.0	.0	excellent deer browse
SYMO	creeping snowberry	25%	15.0	.0	indicates disturbance
VAPA	red huckleberry	25%	1.0	.0	has edible berries
WHMO	whipplevine	25%	15.0	.0	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	27.2	34.1	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	50%	2.0	.0	moist sites, deep, well-drained soil common common, mesic sites
ADBI	trail-plant, pathfinder	25%	1.0	.0	
ANDE	threelaf anemone	25%	3.0	.0	
ASCA3	western wild ginger	25%	1.0	.0	
CAPR3	California harebell	25%	1.0	.0	
COLA	cutleaf goldthread	50%	1.0	.0	
COMA3	spotted coral-root	25%	1.0	.0	
COST2	hooded coral-root	25%	1.0	.0	
DIHOO	Oregon fairybell	50%	1.0	.0	
GAAP	catchweed bedstraw	25%	1.0	.0	
GOOB	rattlesnake-plantain	75%	1.0	.0	
HAL	white-flowered hawkweed	25%	1.0	.0	
LIBOL	western twinflower	25%	1.0	.0	
MOUN2	Indian-pipe	25%	1.0	.0	
OSCH	mountain sweet-root	25%	1.0	.0	
OXOR	Oregon oxalis	100%	6.5	9.1	productive sites with high precipitation and fertile soil  may provide a barrier to planting aggressive competitor after harvest, may be allelopathic to Douglas-fir
PHAD	woodland phlox	25%	1.0	.0	
POMU	western sword-fern	100%	4.8	2.1	
PTAQ	bracken	25%	1.0	.0	
PYPI	whitevein pyrola	75%	1.0	.0	
SESP	spatula-leaf stonecrop	25%	1.0	.0	
SMRA	western false Solomon's-seal	25%	2.0	.0	
SMST	starry Solomon-plume	50%	4.5	4.9	
SYRE	snow-queen	50%	1.0	.0	
TROV	white trillium	25%	1.0	.0	
VIGL	stream violet	25%	1.0	.0	
VIOR2	round-leaved violet	25%	1.0	.0	
	TOTAL HERB	100%	22.7	18.9	
BRPA	Pacific brome	25%	1.0	.0	
CAREX	sedge spp.	25%	1.0	.0	
	TOTAL GRASS	100%	5	1.0	

**WESTERN HEMLOCK - RED ALDER / WESTERN SWORD-FERN**  
*Tsuga heterophylla* - *Alnus rubra* / *Polystichum munitum*  
**TSHE-ALRU/POMU**

**EXTENT:** TSHE-ALRU/POMU occurs on bottomland wet sites, usually lower elevations, of the Ranger Districts of the Western Cascade Subprovince. Sites on Tiller, North Umpqua, and Prospect were sampled. N = 3 plots.

**IDENTIFYING CHARACTERISTICS:** The most distinguishing characteristic of TSHE-ALRU/POMU is the presence of red alder. The Douglas-fir dominated overstory and western hemlock understory is typically present and Pacific yew and the maples are common. This association is similar to TSHE/POMU found throughout the Northwest.

**ABIOTIC ENVIRONMENT:** Basalt, andesite, and diorite are the most common rocks supporting TSHE-ALRU/POMU. Soils are deep, productive, stable, with no operational constraints. Slopes are gentle, relatively smooth, with average dissection.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3180.0	641.0
Aspect (deg)	142.3	3.5
Slope (%)	23.0	15.1
Total soil depth (in)	40.6	16.4
Rooting depth (in)	46.5	6.1
Total basal area (ft <sup>2</sup> /ac)	253.3	46.2

**CLIMATE:** The estimated temperature and moisture regime is warm, dry. A warm regime accurately describes the Association; it occurs in low elevation, protected benchlands and bottoms. But dry is inaccurate. Rainfall amounts are estimated to be low, but the low elevation protected position retains high humidity most of the day and well into summer. Red alder indicates such a marine influence where evapotranspirational demand is low and cloud cover is common during the summer.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.2	1.8
Maximum month temp(F)	82.0	2.5
Mean annual ppt (in)	56.7	15.3
Dry season ppt (in)	7.7	1.5

**FOREST FLOOR:** Forest floor conditions are similar to the Western Hemlock Series averages where litter (needles, leaves, branches and decomposing logs) covers about 90 percent of the forest floor and usually less than 10 percent of the surface is covered by gravel, bare ground, rock, or exposed bedrock. Moss usually covers some of the rock or litter and averages about 24 percent.

FOREST FLOOR	MEAN	S.D.
Litter (%)	91.7	2.9
Moss (%)	24.3	14.4
Bareground (%)	1.7	2.9
Gravel (%)	1.0	1.7
Rock (%)	1.3	1.5
Bedrock (%)	.0	.0

**VEGETATION:** TSHE-ALRU/POMU is an unusual Association as red alder is not usually a long lived, climax species. Most associations are named after more stable vegetation. This bench, bottomland position is subject to disturbance by flooding. Repeated flooding would allow red alder to continually occupy sites that would otherwise be taken over by western redcedar or western hemlock.

**SILVICULTURE:** Western hemlock and red alder are by far the most efficient species. Douglas-fir, white fir, incense-cedar, and Pacific yew are about equal in abundance, but Pacific yew grows significantly slower. Big-leaf and vine maple, and red alder are efficient competitors and have the potential to reduce crop tree diameter growth (unless, of course, they are the crop trees). The potential need for vegetation management is high. Natural regeneration of conifers will be hindered by the hardwoods, even though most sites are climatically moderate. Achieving planned stocking levels and maintaining growth rates throughout the rotation will require balancing survival requirements (reducing the levels of competing vegetation) with long-term growth needs (maintaining hardwoods for microclimate, cycling nutrients, and wildlife habitat).

**WATERSHED MANAGEMENT:** TSHE-ALRU/POMU occurs on highly dissected slopes, with 3.3

streams per half mile. It is exclusively found on bottomland benches which are subject to occasional flooding. Sites tend to be concave, or slightly so, relatively warm, do not accumulate snow, and generally are easily revegetated after disturbance, particularly with alder.

**FIRE MANAGEMENT:** Possibly because of the wet, bottomland character of TSHE-ALRU/POMU fire occurrence is extremely low. No evidence of fire was found in any of the four sites sampled. We speculate that the fire regime would differ from the Series average. Even in extreme conditions, if the fire is not funneling up the canyon, it is unlikely that a backing flame would do much damage to most vascular species in moist duff. Disturbance is mostly a result of high water events rather than fire.

**RANGE & WILDLIFE MANAGEMENT:** TSHE-ALRU/POMU is not a common Association. It usually is located near streams, seeps, or other wet areas. It may have some potential for transitory range use,

however, it is not common or extensive. Herb and shrub cover average 33 and 61 percent respectively. Browse species, blackberries, California hazel, Pacific dogwood, and red huckleberry tend to occur in scattered clumps. It is a cool, low elevation habitat, even in summer and may be used as a thermal neutral zone. As with many of the Associations within the Series, *Hemitomes congestum*, an unusual saprophyte, may be present.

**RECREATION & VISUAL MANAGEMENT:** Except for the tendency for TSHE-ALRU/POMU to occur near streams, it is similar to typical TSHE sites. The red alder is an indication of frequent but incomplete disturbance. Development in TSHE-ALRU/POMU may be difficult to maintain; minor floods are common. Red alder does not detract from the visual character although the leaves turn an ugly brown in the fall. Its whitish bark and conical shape provides a mild contrast against a dominant conifer backdrop.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PIMO	western white pine	33%	1.0	.0	frost tolerant
PSME	Douglas-fir	100%	46.7	15.3	a pioneer after disturbance
TSHE	western hemlock	66%	15.0	7.1	efficient in this Association
	TOTAL OVERSTORY	100%	57.0	21.4	
	—CONIFERS—				
ABCO	white fir	66%	17.5	17.7	
CADE3	incense-cedar	33%	5.0	.0	tolerates soil and climatic extremes
PSME	Douglas-fir	33%	1.0	.0	a pioneer after disturbance
TABR	Pacific yew	100%	13.7	10.0	a good Association to grow yew
TSHE	western hemlock	100%	42.0	9.8	high producer
	—HARDWOODS—				
ACCI	vine maple	100%	66.7	15.3	a severe competitor with young conifers
ACMA	big-leaf maple	33%	20.0	.0	a severe competitor with young conifers
ALRU	red alder	100%	3.0	2.0	a severe competitor with young conifers, fixes nitrogen
CACH	golden chinquapin	66%	2.0	.0	what is this doing here???
	TOTAL UNDERSTORY	100%	147.0	27.9	
AMAL	western serviceberry	33%	5.0	.0	provides deer browse
BENE	dwarf Oregongrape	100%	4.0	1.7	deep, fertile soils
CHME	little prince's-pine	33%	1.0	.0	
CHUM	common prince's-pine	66%	2.0	1.4	drier sites, cool to warm
CONU	Pacific dogwood	66%	5.5	3.5	provides good big game browse
COST	red-osier dogwood	33%	5.0	.0	provides good big game browse
COCOC	California hazel	66%	2.5	.7	provides good big game browse
GASH	satal	66%	42.0	53.7	warmer, drier indicator, productive sites
HODI	creambush ocean-spray	33%	3.0	.0	provides good deer browse
LOCI	trumpet honeysuckle	33%	2.0	.0	
RHMA	Pacific rhododendron	66%	7.5	6.4	may be a vegetation management problem
ROGY	baldhip rose	66%	3.5	2.1	hips contain high levels of vitamin C
RULA	dwarf bramble	33%	1.0	.0	provides food for birds
RUPA	thimbleberry	33%	1.0	.0	has edible berries
RUUR	Pacific blackberry	100%	5.3	3.8	provides deer browse
VAME	thin-leaved huckleberry	33%	1.0	.0	edible berries, provides food for bears
VAPA	red huckleberry	66%	3.0	1.4	edible berries
WHMO	whipplevine	66%	2.0	1.4	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	61.0	62.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	66%	1.0	.0	moist sites, deep, well-drained soils common
ADBI	trail-plant, pathfinder	66%	1.0	.0	
AQFO	Sitka columbine	33%	1.0	.0	
ASCA3	western wild ginger	33%	3.0	.0	wet sites
BLSP	deer-fern	33%	3.0	.0	
CLUN	queen's cup	66%	1.0	.0	
COMA3	spotted coral-root	33%	1.0	.0	indicates cool, moist sites
COST2	hooded coral-root	33%	1.0	.0	
DIHOO	Oregon fairybell	33%	3.0	.0	
GAAP	catchweed bedstraw	66%	1.0	.0	unusual
GOOB	rattlesnake-plantain	100%	1.0	.0	
HECO	gnome-plant	33%	1.0	.0	
HEMI	smallflower alumroot	33%	3.0	.0	very common
LIWA	Washington lily	33%	1.0	.0	
LIBOL	western twinflower	100%	11.7	15.9	
LICA3	northwest listera	33%	1.0	.0	preferred by mountain beavers to line burrows
POMU	western sword-fern	100%	8.0	7.0	
PYPI	whitevein pyrola	33%	1.0	.0	
SMST	starry Solomon-plume	33%	1.0	.0	indicates moist environments
TITR	foamflower	33%	1.0	0	
TRLA2	western starflower	66%	1.5	7	
TROV	white trillium	66%	1.0	.0	moderately dry to moist sites, disturbed sites
VAHE	white inside-out-flr	33%	1.0	0	
VIGL	stream violet	33%	1.0	.0	
VIOR2	round-leaved violet	33%	1.0	.0	mesic sites
	TOTAL HERB	100%	33.7	9.1	
FEOC	western fescue	66%	1.0	.0	
	TOTAL GRASS	100%	.7	.6	



## WESTERN REDCEDAR SERIES

*Thuja plicata*

THPL

Minore's two publications (Minore 1979, Minore 1983) were the source for most of the material presented in this section.

Western redcedar has a bimodal distribution in western North America. There is an interior range, including the northern half of Idaho, fringes of western Montana west of the Continental Divide, and the southeastern corner of British Columbia. The coastal range extends farther, both north and south. It begins at the southern most tip of southeastern Alaska, and continues through western Washington and Oregon west of the Cascade Mountain crest. In southwestern Oregon the distribution tapers to a slender finger extending into northern California. The tapering begins where the Oregon Coast Range and the Siskiyou Mountains meet. At that point, western redcedar is found sporadically along the coast in areas where the environment is moderated by the coast. In the southern finger, western redcedar is found only where moisture is readily available during the entire growing season—even to the point where it is found only in boggy environments in northern California (Minore 1983).

This guide deals with the southern most occurrence of western redcedar in the Oregon Cascades. Indeed, we encountered western redcedar only on plots in the Umpqua National Forest, even though it has been located in some pockets of the Prospect Ranger District on the Rogue River National Forest.

Western redcedar is one of the most shade tolerant species in the Pacific Northwest. Locally, only Pacific silver fir (*Abies amabilis*), Pacific yew (*Taxus brevifolia*), western hemlock (*Tsuga heterophylla*), and perhaps mountain hemlock (*Tsuga mertensiana*) are more shade tolerant. Of these, only western hemlock and Pacific yew co-occur with western redcedar. Because almost every occurrence of western redcedar has western hemlock as an associated species (96 percent), much of the discussion in this Series will be comparative between the two species.

Western redcedar locations are warmer and receive more rainfall than the average ecology plot in the Cascades; in fact they are slightly warmer and receive more precipitation than all western hemlock occurrences in the Cascade ecological data base.

This species has a high resistance to both insects and disease. Even though it may serve as a host for a wide variety of pathogens, their effect on western redcedar is minimal (Minore 1979).

### THE SERIES

**EXTENT:** The Series is most common on the Umpqua National Forest, both High and Western Cascades, and north of the North/South Umpqua Divide (the ridge between Tiller and North Umpqua Ranger Districts). N = 13 plots.

**IDENTIFYING CHARACTERISTICS:** Western redcedar is present on 73 ecology plots (13 percent of the data base) in the Cascade Mountain Province of southwestern Oregon. It is almost always associated with western hemlock (96 percent) and Douglas-fir (overstory 100 percent, understory 48 percent). The most frequent shrub layer associates are vine maple (79 percent) and salal (82 percent).

We have identified two plant associations in which the dominant climax species is western redcedar. In both cases, western hemlock is strongly associated with the western redcedar in the understory. For comparison, there are five associations in the Western Hemlock Series in which western redcedar is the co-dominant climax species. There is a high degree of similarity between the seven associations. The key factor is the edge in regeneration towards western redcedar.

**ABIOTIC ENVIRONMENT:** This Series is found on a wide range of parent materials, including volcanic ejecta and intrusive rocks (andesite and basalt).

Most abiotic environmental variables mirror Cascade Province averages. Exceptions are elevation and aspect as outlined below. The Western Red-

cedar Series is found in all slope positions between upper third and stream bottoms, and on convex, concave, and undulating terrain.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	2100	4120	2020	2936.0	536.0	less than the population average
Aspect (deg)	-	-	-	44.3	118.6	northeast, but with a lot of variation
Slope (%)	5	65	60	29.0	19.9	same as population average
Total soil depth (in)	24	50	26	45.6	8.9	same as population average
Rooting depth (in)	24	50	26	47.2	7.6	same as population average
Total basal area (ft <sup>2</sup> /ac)	200	480	280	323.1	94.5	slightly more than the population average

**CLIMATE:** The two western redcedar associations are slightly warmer and drier than the average for the Western Hemlock Series (Figure 10). Moisture

most limits annual growth, although temperature extremes, both high and low, limits its range.

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	44	50	6	47.4	1.7	same as population average
Maximum month temp (F)	78	86	9	82.8	2.3	same as population average
Mean annual ppt (in)	60	70	10	64.4	3.9	greater than the population average
Dry season ppt (in)	7	9	2	8.0	.7	same as population average

**FOREST FLOOR:** Western redcedar produces more litter than any other Pacific Northwest conifer, and the wood is extremely resistant to decay. Thus,

litter cover would be high if the environment were not warmer and moister than other sites--ideal conditions for litter decomposition.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	20	100	80	82.4	22.0	less than the population average
Moss (%)	2	80	78	29.4	25.4	greater than the population average
Bareground (%)	0	1	1	.2	.4	
Gravel (%)	0	8	8	1.2	2.4	
Rock (%)	0	5	5	1.0	1.7	
Bedrock (%)	0	15	15	1.2	4.2	

**VEGETATION:** The Western Redcedar Series is actually more diverse than most Series in the Cascade Province. In addition to the 8 coniferous and 6 hardwood tree species, there were 20 shrub, 55 herb, and 6 grass(-like) species (or genera) identified in the two associations. Most species are typical for the mesic zone of the Cascade Mountains. The exceptions are those normally occurring on more moist sites (e.g., red alder, several ferns, and yellow skunk cabbage).

principal components of the shrub and low hardwood layer; the weighted average total cover of these four species is 60 percent. The predominant herbs are those usually found on Cascade Mountain forested sites, including rattlesnake plantain, western twinflower, and white trillium.

Western redcedar and western hemlock co-occur on all Series plots; they are the climax conifers. Douglas-fir regeneration and Pacific yew occurs on two-thirds of the plots. Vine maple, Pacific rhododendron, salal, and dwarf Oregongrape are the

**SILVICULTURE:** Douglas-fir, white fir, and incense-cedar are appropriate species for reforestation. Western hemlock and western redcedar are more efficient on undisturbed sites with some overstory cover and often are present in older stands as advanced regeneration. Use of white fir and incense-cedar should be on a site-specific basis, white fir in the cooler and incense-cedar in the warmer microenvironments.

Western redcedar is a prolific seeder and often natural regeneration can be taken advantage of in reforestation. However, redcedar seed does not spread as far as western hemlock, so unit layout will have to be considered in natural regeneration probabilities if western redcedar is the desired species. Site preparation is not necessarily advantageous in overall reforestation activities. Research has shown that seedling germination is best on mineral soil, but growth potential of the survivors is best where sites were unburned (this relationship maybe the opposite in the inland portion of western redcedar's range). Other studies indicate survival is less when germination occurs on rotten woody material, but growth of the survivors on the rotten wood exceeds that of those on mineral soil and that advantage is maintained through succession (Minore 1983). The best combination seems to be unburned sites with

some exposed mineral soil, perhaps created by the logging activities.

There are no significant limitations to harvest systems in the Series. Care should be taken in identifying redcedar as leave trees, either as seed or wildlife trees, because they are shallow rooted. Vegetation management may be necessary to control pockets of vine maple or Pacific rhododendron. Both growth and survival may be hindered. Care should be taken with intermediate entries because redcedar is susceptible to some root rot if over-stressed. (See Minore 1983 for a more detailed discussion and additional references.)

The table below compares different features of the two associations in this series.

	THPL/RHMA/LIBOL	THPL/WHMO/ANDE
Slope position	Middle to lower third	Middle to upper third
Annual precipitation	Slightly more	Slightly less
Elevation	Broader range; higher	Narrower range; lower
Aspect	Northwest by north	East by southeast
Basal area	Higher by 30 percent	Lower
Disturbance	Disturbed by fire and man	Disturbed mostly by man
Evapotranspirational demand	Lower	Higher
Species diversity	Higher	Lower

**WATERSHED MANAGEMENT:** Snow accumulation is rare in the Series. Rainfall averages approximately 60 inches, but evaporative demand is low. Many sites are on the lower third of the slope or bottom-land locations, close to perennial streams. Soils are deep and well drained, and revegetation is rapid.

**FIRE MANAGEMENT:** Fire frequency, severity, and risk is low. Most fires back down into western redcedar stands and are of low intensity. Fire scars or "cat-faces" may be occasionally found. They develop from the build up of litter at the base of the tree, which allows for extended burning time on the uphill side where litter accumulation is greatest. It is common to find one or two trees with scars and the date of burning does not usually coincide.

**RANGE AND WILDLIFE MANAGEMENT:** Adjacent to riparian ecosystems, the western redcedar Series is one on the most important when considering fish and wildlife needs. It often provides the coarse wood for nearby streams, shade, and travel corridors for deer and elk. It tends to link different plant associations and seral stages with a relatively stable, diverse environment. Water is usually nearby and herbaceous cover can be high and palatable. Structure varies from dense thickets of riparian species to various layers of understory western redcedar and western hemlock.

**RECREATION AND VISUAL MANAGEMENT:** Recreational use has been related to traditional uses of nearby streams. The visual variety is pleasing, but off-trail foot travel is difficult in the steep, densely vegetated terrain.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABCO	white fir	23%	15	33	18	24.3	9.0	
CADE3	incense-cedar	30%	5	15	10	11.2	4.8	
PILA	sugar pine	38%	5	25	20	10.0	8.7	
PSME	Douglas-fir	100%	10	75	65	46.7	23.0	
THPL	western redcedar	30%	7	10	3	9.3	1.5	
TSHE	western hemlock	46%	5	40	35	15.8	12.4	
	TOTAL OVERSTORY	100%	10	110	100	69.8	23.8	
	--CONIFERS--							
ABCO	white fir	30%	5	30	25	18.7	10.3	
CADE3	incense-cedar	30%	2	15	13	8.0	5.7	
PILA	sugar pine	7%	1	1	0	1.0	.0	
PIMO	western white pine	7%	1	1	0	1.0	.0	
PSME	Douglas-fir	61%	2	40	38	13.1	12.7	
TABR	Pacific yew	69%	2	20	18	5.9	5.4	
THPL	western redcedar	100%	3	55	52	29.8	14.9	
TSHE	western hemlock	92%	5	35	30	18.6	11.1	
	--HARDWOODS--							
ACCI	vine maple	76%	1	30	29	15.2	10.1	
ACGL	Douglas maple	7%	5	5	0	5.0	.0	
ACMA	big-leaf maple	23%	5	5	0	5.0	.0	
ALRU	red alder	7%	1	1	0	1.0	.0	
ARME	Pacific madrone	23%	2	7	5	4.7	2.5	
CACH	golden chinquapin	53%	1	20	19	5.6	6.9	
	TOTAL UNDERSTORY	100%	58	105	47	84.9	14.1	
BENE	dwarf Oregongrape	92%	2	20	18	9.7	5.5	
CHUM	common prince's-pine	46%	1	10	9	3.7	3.4	
CONU	Pacific dogwood	30%	3	10	7	5.0	3.4	
GASH	salal	84%	1	40	39	15.5	14.2	
RHMA	Pacific rhododendron	84%	8	85	77	31.1	23.9	
ROGY	baldhip rose	61%	1	6	5	2.1	1.7	
RUUR	Pacific blackberry	61%	1	3	2	2.1	.8	
VAPA	red huckleberry	61%	1	15	14	6.8	4.9	
WHMO	whipplevine	53%	2	22	20	9.0	8.4	
	TOTAL SHRUB	100%	34	132	98	67.1	27.8	
ACTR	vanillaleaf	61%	1	3	2	1.9	1.0	
ADBI	trail-plant, pathfinder	38%	1	10	9	3.4	3.8	
ANDE	threeleaf anemone	53%	1	7	6	2.6	2.1	
CLUN	queen's cup	38%	1	1	0	1.0	.0	
COLA	cutleaf goldthread	38%	1	5	4	2.2	1.6	
DIHOO	Oregon fairybell	53%	1	3	2	1.4	.8	
GAAP	catchweed bedstraw	53%	1	2	1	1.3	.5	
GOOB	rattlesnake-plantain	92%	1	1	0	1.0	.0	
HAL	white-flowered hawkweed	53%	1	5	4	1.6	1.5	
LIBOL	western twinflower	92%	2	60	58	12.4	16.0	
OXOR	Oregon oxalis	30%	1	25	24	9.5	11.1	
POMU	western sword-fern	61%	1	3	2	1.8	.7	
PTAQ	bracken	30%	1	2	1	1.3	.5	
SMRA	western false Solomon's-seal	23%	1	1	0	1.0	.0	
SMST	starry false Solomon's-seal	46%	1	3	2	1.3	.8	
SYRE	snow-queen	30%	1	2	1	1.3	.5	
TITR	foamflower	30%	2	4	2	2.5	1.0	
TRLA2	western starflower	53%	1	2	1	1.1	.4	
TROV	white trillium	76%	1	2	1	1.1	.3	
VIGL	stream violet	53%	1	5	4	1.7	1.5	
VIOR2	round-leaved violet	46%	1	5	4	2.2	1.5	
	TOTAL HERB	100%	7	93	86	38.9	28.4	
BRPA	Pacific brome	15%	1	2	1	1.5	.7	
FESU	bearded fescue	23%	1	1	0	1.0	.0	
	TOTAL GRASS	100%	0	4	4	.8	1.1	

## WESTERN REDCEDAR KEY

- |    |   |                 |
|----|---|-----------------|
| 1a | Whipplevine [WHMO], baldhip rose [ROGY], Oregon fairybell [DIHOO],<br>and threeleaf anemone [ANDE] present. | THPL/WHMO/ANDE  |
| 1b | None of the above present, or at most one of the four.  | THPL/RHMA/LIBOL |

## WESTERN REDCEDAR ASSOCIATIONS

THPL/RHMA/LIBOL pg. 196	Western redcedar / Pacific rhododendron / Western twinflower <i>Thuja plicata</i> / <i>Rhododendron macrophyllum</i> / <i>Linnaea borealis longiflora</i>
THPL/WHMO/ANDE pg. 199	Western redcedar / Whipplevine / Threeleaf anemone <i>Thuja plicata</i> / <i>Whipplea modesta</i> / <i>Anemone deltoides</i>

**WESTERN REDCEDAR / PACIFIC RHODODENDRON / WESTERN TWINFLOWER**  
*Thuja plicata* / *Rhododendron macrophyllum* / *Linnaea borealis longiflora*  
**THPL/RHMA/LIBOL**

**EXTENT:** On the Umpqua National Forest this Association occurs on the North Umpqua, Cottage Grove, and Diamond Lake Ranger Districts. It occurs in the Western Cascades, and possibly in the High Cascades. N = 6 plots.

**IDENTIFYING CHARACTERISTICS:** Western redcedar is the climax dominant conifer, with western hemlock as codominant. The absence of the four species (or most of them) listed in the key (whipplevine, baldhip rose, Oregon fairybell, and three-leaf anemone) is the most significant identifying difference between THPL/RHMA/LIBOL and THPL/WHMO/ANDE. This Association occurs on middle to lower third slope positions.

If an error is made by selecting the Western Hemlock Series, sites in this Association may key out to either TSHE-PSME/GASH or TSHE/GASH/LIBOL. This Association is similar to both. Extra care will be necessary in reviewing the descriptions of vegetation and the environment to select the best fit. No associations similar to this one have been described elsewhere in the Pacific Northwest Region.

**ABIOTIC ENVIRONMENT:** Parent materials are volcanic in origin, split evenly between igneous intrusives and extrusives (pumice and ash). The ash is young and has been redeposited by water or wind. This Association is characteristically found on the middle to lower third of the slope and sometimes in draws or intermittent stream bottoms; although the mean elevation is less than THPL/WHMO/ANDE. Slopes are also somewhat gentler. Aspects are northwest by north, in contrast to the east aspects of the other western redcedar association.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3070.0	594.0
Aspect (deg)	332.1	88.8
Slope (%)	24.3	15.6
Total soil depth (in)	45.6	10.8
Rooting depth (in)	45.6	10.8
Total basal area (ft <sup>2</sup> /ac)	370.0	101.8

Rooting is deep, seemingly unrestricted, and productivity is high.

**CLIMATE:** Environmentally, this Association is cooler and drier than THPL/WHMO/ANDE. Evapotranspirational demands are low. Sites tends to occur in areas associated with high humidity and fog. Rainfall is not unusually high, and summer temperatures are moderate.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.1	1.8
Maximum month temp (F)	82.3	2.5
Mean annual ppt (in)	62.5	2.9
Dry season ppt (in)	7.8	1.0

**FOREST FLOOR:** Most forest floor characteristics are typical for the Cascades. Litter and moss, however, are slightly less than (90 percent) and greater than (14 percent) the population averages, respectively. Although western redcedar litter is somewhat resistant to decomposition, the warm, moist environment increases decomposition rates.

FOREST FLOOR	MEAN	S.D.
Litter (%)	80.8	30.6
Moss (%)	31.2	34.4
Bareground (%)	.0	.0
Gravel (%)	.2	.4
Rock (%)	.8	2.0
Bedrock (%)	2.5	6.1

**VEGETATION:** This Association is climax to western redcedar and western hemlock. Pacific yew and golden chinquapin frequently occur in the tree understory. Pacific rhododendron (37 percent cover) and dwarf Oregongrape (10 percent cover) occur on all plots; salal is common (9 percent cover). The herbaceous layer is almost nondescript with respect to the average Cascade site; western twinflower (16 percent) is always present and rattlesnake-plantain has the usual low coverage and is common. The significant differences are on the isolated plot that has moist-site indicators, e.g.,

ferns like maidenhair spleenwort and deer-fern, and the saxifrage, mountain boykinia.

Douglas-fir, with redcedar and hemlock, will invade the site after a major disturbance. All three are well suited for seeding in on mineral soil, however redcedar's growth will be enhanced by a protected environment, i.e., partially exposed mineral soil, shaded microsites, and large woody material. After canopy closure occurs and seed production begins, all three will continue to regenerate, but Douglas-fir will be in the minority.

**SILVICULTURE:** Douglas-fir, western hemlock, and western redcedar are appropriate species for regeneration. Advanced regeneration can be utilized in reforestation as long as site preparation activities do not damage it. Sites should be treated gently if the late seral conifers are desired. High evapotranspirational rates put more demands on resource management, including actively recruiting and maintaining manageable levels of large woody material. The material is particularly useful as moisture reservoirs, ameliorating environmental conditions and acting as a nutrient source for survival and growth of regeneration.

Pacific rhododendron is the only significantly potential source of vegetation management problems. It is present on all plots with an average cover of 37 percent. Advanced regeneration and early establishment of planted stock will reduce the risk of competition.

**WATERSHED MANAGEMENT:** This Association occurs at elevations where most precipitation is in

the form of rain. Only during extreme weather patterns will temperatures remain low enough for snow accumulation. Soils rarely, if ever, freeze to the point of inhibiting infiltration. Ash soils are usually porous and percolation rates are high. Vegetation canopies are multi-layered and well developed.

**FIRE MANAGEMENT:** The physical characteristics of THPL/RHMA/LIBOL tend to reduce wildfire risks. This Association is usually located on the lower third or toe of slopes; micro-relief is concave to undulating. These features reduce effects of slope position and wind on drying and tend to maintain fuel moistures at slightly elevated levels. The fuel mosaic is fairly continuous from herbs up through shrubs and hardwoods to conifer regeneration and canopies.

**RANGE & WILDLIFE MANAGEMENT:** Forage values are low in this Association. Little to no grass occurs and the herb/shrub cover has no highly favored browse species. Hiding and thermal cover is high, although the rhododendron may hinder animal movement. Western redcedar snags and downed material are somewhat resistant to decay so they will persist in the stand longer than most other species. Golden chinquapin occurs on most plots and is a source of mast for some small mammals.

**RECREATION & VISUAL MANAGEMENT:** These sites are pleasant to view, but difficult to walk through. Because THPL/RHMA/LIBOL occurs near streams, recreation potential may be higher than the average association.

#### PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PILA	sugar pine	33%	5.0	.0	could be confused with western white pine seral dominant climax co-climax, productive
PSME	Douglas-fir	100%	43.3	22.3	
THPL	western redcedar	33%	8.5	2.1	
TSHE	western hemlock	50%	23.3	14.4	
	TOTAL OVERSTORY	100%	59.5	31.8	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
	—CONIFERS—				
PIMO	western white pine	16%	1.0	.0	could be confused with sugar pine
PSME	Douglas-fir	50%	20.0	18.0	indicates dry sites or disturbance
TABR	Pacific yew	83%	7.2	7.3	slow grower, very tolerant
THPL	western redcedar	100%	38.3	12.1	out-competes hemlock on drier sites
TSHE	western hemlock	100%	24.2	11.6	higher cover on moister sites
	—HARDWOODS—				
ACCI	vine maple	50%	8.7	6.0	potential vegetation management consideration
ARME	Pacific madrone	16%	5.0	.0	disturbance indicator; fades from stand around age 100
CACH	golden chinquapin	83%	2.2	1.8	mast for forage
	TOTAL UNDERSTORY	100%	85.7	13.9	
BENE	dwarf Oregongrape	100%	10.2	5.0	high productivity indicator
CHME	little prince's-pine	16%	1.0	.0	
CHUM	common prince's-pine	50%	6.0	3.6	ubiquitous
CONU	Pacific dogwood	16%	10.0	.0	
GAOV	slender salal	33%	1.5	.7	cool, moist
GASH	salal	83%	9.4	9.6	drier indicator, productive
LOHI	hairy honeysuckle	33%	1.0	.0	warm, dry sites
PAMY	Oregon boxwood	33%	1.0	.0	cool sites
RHMA	Pacific rhododendron	100%	36.7	30.3	ranges from 8-85 percent cover
ROGY	baldhip rose	16%	1.0	.0	
RULA	dwarf bramble	16%	2.0	.0	
RUNI	snow bramble	33%	3.5	2.1	cool, moist sites
RUSP	salmonberry	16%	2.0	.0	
RUUR	Pacific blackberry	50%	2.0	1.0	disturbance indicator
VAME	thin-leaved huckleberry	50%	3.0	3.5	cool, moist sites
VAPA	red huckleberry	66%	8.8	5.7	drier sites
	TOTAL SHRUB	100%	71.0	21.6	
ACTR	vanillaleaf	33%	2.0	1.4	
ASTR	maidenhair spleenwort	16%	1.0	.0	
BLSP	deer-fern	16%	1.0	.0	
BOMA	mountain boykinia	16%	3.0	.0	
CLUN	queen's cup	33%	1.0	.0	
COLA	cutleaf goldthread	50%	3.0	1.7	
COCA	bunchberry	16%	3.0	.0	
GAAP	catchweed bedstraw	33%	1.0	.0	
GOOB	rattlesnake-plantain	83%	1.0	.0	
HECO	gnome-plant	16%	1.0	.0	
HAL	white-fl'd hawkweed	33%	1.0	.0	warm, dry indicator
LIBOL	western twinflower	100%	16.2	22.4	ubiquitous, productive sites
LICA3	northwest listera	16%	1.0	.0	
LYAM	yellow skunk cabbage	16%	1.0	.0	moist, almost bog-like, indicator
MOUN2	Indian-pipe	16%	1.0	.0	
OXOR	Oregon oxalis	50%	9.3	13.6	warm, moist indicator
PERA	leafy lousewort	16%	3.0	.0	
POMU	western sword-fern	66%	1.8	.5	warm to mild, moist indicator
PTAQ	bracken	33%	1.0	.0	
PYAP	leafless pyrola	16%	1.0	.0	
PYAS	alpine pyrola	16%	1.0	.0	
PYSE	one-sided pyrola	16%	1.0	.0	cool indicator
SMRA	western false Solomon's-seal	16%	1.0	.0	
SMST	starry false Solomon's-seal	33%	1.0	.0	
SYRE	snow-queen	16%	1.0	.0	
TITR	foamflower	50%	2.7	1.2	warm, moist indicator
TRLA2	western starflower	33%	1.0	.0	
TROV	white trillium	50%	1.0	.0	
VIAM	American vetch	16%	1.0	.0	
VIGL	stream violet	66%	1.0	.0	warm, moist indicator
VIOR2	round-leaved violet	33%	1.5	.7	
XETE	common beargrass	33%	2.5	.7	
	TOTAL HERB	100%	34.3	29.2	
FESU	bearded fescue	16%	1.0	.0	
	TOTAL GRASS	100%	.2	.4	



**WESTERN REDCEDAR / WHIPPLEVINE / THREELEAF ANEMONE**  
*Thuja plicata* / *Whipplea modesta* / *Anemone deltoides*  
**THPL/WHMO/ANDE**

**EXTENT:** THPL/WHMO/ANDE occurs on the North Umpqua, Cottage Grove, and Diamond Lake Ranger Districts of the Umpqua National Forest. It is associated with the Western Cascade Geological Province. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** Western redcedar is the climax dominant; western hemlock is the most common co-dominant. The presence of four species (or some combination of them) listed in the key (whipplevine, baldhip rose, Oregon fairybell, and threeleaf anemone) is most significant in identifying the difference between THPL/WHMO/ANDE and THPL/RHMA/LIBOL. This Association is often found on the upper to middle third of the slope.

If an error is made by selecting the Western Hemlock Series, sites in this Association may key out to either TSHE-PSME/GASH, TSHE/GASH/LIBOL, or rarely TSHE/ACCI/RUNI. This Association is similar to the first two; the rare occurrence of Oregon oxalis will push selection towards the TSHE/ACCI/RUNI association. Similar associations are not described elsewhere in the Pacific Northwest Region.

**ABIOTIC ENVIRONMENT:** Parent material is commonly andesite or basalt and occasionally tephra that has been redeposited by water or wind. This Association is characteristically found on the upper to middle third of the slope and occasionally on the lower third. The mean elevation is slightly higher than THPL/RHMA/LIBOL and slopes are somewhat steeper. Aspects are primarily east, in contrast to the northwest by north aspects of the other western redcedar association. Rooting depths are slightly deeper than the average for the Western Hemlock Series.

ABIOTIC MEAN	S.D.	
Elevation (ft)	2821.0	497.6
Aspect (deg)	104.8	91.1
Slope (%)	33.0	23.4
Total soil depth (in)	45.5	7.8
Rooting depth (in)	48.5	4.0
Total basal area (ft <sup>2</sup> /ac)	282.9	71.6

**CLIMATE:** The environment on THPL/WHMO/ANDE sites is mild. Evapotranspirational demand is low, summer temperatures are warm, not hot, and moisture stress is low. Soils on the lower slope positions often are continually recharged from above. Soil temperatures are high, rarely frozen, and do not limit nutrient uptake. Moisture stress probably occurs late in the growing season, but nutrition probably most limits biomass production.

CLIMATE MEAN	S.D.	
Mean annual temp (F)	47.7	1.8
Maximum month temp (F)	83.2	2.3
Mean annual ppt (in)	66.0	4.2
Dry season ppt (in)	8.2	0.4

**FOREST FLOOR:** Litter cover, rather than being above 90 percent, usually is about 80 percent. Decomposition rates, related to ambient temperature and availability of water, are high. Thus, litter, fine and coarse, decompose quickly. The high cover of moss is another indication of warm site conditions. Although stands with bedrock were not sampled, the amount of exposed rock is dependent on the form of the slope itself. Concave slopes near streams that are rapidly cutting tend to have high cover of bedrock. Concave slopes tend to collect soil, litter, and water from above.

FOREST FLOOR MEAN	S.D.	
Litter (%)	83.7	13.5
Moss (%)	27.9	17.3
Bareground (%)	.4	5
Gravel (%)	2.0	3.1
Rock (%)	1.1	1.5
Bedrock (%)	.0	0

**VEGETATION:** A combination of seven conifers and six hardwoods occur in the Association. Although western redcedar and western hemlock tend to dominate in later seral stages, early in succession (50-150 years) the conifers tend to be similar in cover. Only sugar pine may be poorly represented. Generally the hardwoods tend to be early

successional. Big leaf maple, red alder, and Pacific madrone occur where nature has created openings or opportunities for invasion (small pockets created by blowdown, insects, slides, or disease). Big leaf maple is mostly associated with disturbance in the northern portion of the area, but is increasingly associated with drainages in the southern Cascades. Dwarf Oregongrape, salal, Pacific rhododendron, and baldhip rose, common in the Cascades are present and dominant in THPL/WHMO/ANDE.

**SILVICULTURE:** Species diversity provides a variety of opportunities. Maintaining the existing complement of species is first priority, but the prescribed proportion depends on forest, basin, and site specific goals. Hardwoods provide rapid growth and revegetation, particularly on severely disturbed sites. They also contribute to nutrient retention and cycling. Their role shouldn't be overlooked when prescribing for long-term site needs. The degree of disturbance may be used to help control species mix (approximately half of the variety in species mix is chance, depending on which species produce an abundant, viable seed crop, and timing). If the site is left relatively undisturbed, late seral conifers such as western redcedar, western hemlock, white fir, and Pacific yew will be favored. If the full complement of species is desired, a range of intensity of disturbance may be necessary. Planting may be necessary to establish densities desired. Sugar pine and Douglas-fir may need to be planted if the site is not burned or disturbed to mineral soil.

Shrub and hardwood competition is likely. If a conifer crop is planned, red alder, madrone, big-leaf maple, rhododendron, and vine maple, alone or in combination significantly affect the early growth of conifers. Where they are already well established, correction is the appropriate strategy (see the Vegetation Management EIS implementation plan). If cover is less than 20 percent, it would be best to use advanced regeneration where possible, or do not provide invasion opportunities by severely disturbing the site. Higher than recommended stocking

levels may allow the conifers to control site resources. However, the best preventative strategy is to assure proper species mixes with the best adapted individuals. An additional problem associated with vegetation management is the nearness to streams (this Association may occur on bottomland positions adjacent to streams). Any tool, chemical or mechanical, is more likely to have an effect on water quality.

**WATERSHED MANAGEMENT:** When THPL/WHMO/ANDE is found near streams, management direction should be conservative. It is a resilient, productive Association that rapidly recovers after disturbance. Snow pack is uncommon, and rainfall averages about 66 inches. Soils are deep, porous, and have a relatively high water holding capacity.

**FIRE MANAGEMENT:** Occasionally fire scars are found in THPL/WHMO/ANDE. But, the fire regime is typically low intensity fires that back down into the lower slope positions that burn pockets of accumulated litter. Stands are usually uneven-aged, with a variety of species at various levels in the understory. Vertical continuity exists, but the high humidity and low exposure to wind, and relatively moist fuels, dampen risk.

**RANGE & WILDLIFE MANAGEMENT:** The variable structure in the understory provides thermal cover, hiding cover, snags, and coarse downed wood. Water is often nearby and temperature extremes are dampened. The Association is ideal for wildlife. Since it is rarely burned, it is usually part of a travel network for animals. Forage is available early in the spring since snow pack is rarely a barrier.

**RECREATION & VISUAL MANAGEMENT:** Species composition and stand structure provide visual variability from a foreground perspective. From within, the stand is cool, but brushy, and navigation is difficult even though slopes are not steep. Water is often nearby, and in cases where the streams bare fish, recreational potential exists.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	42%	24.3	9.0	could be confused with western white pine seral dominant climax co-climax, productive
CADE3	incense-cedar	57%	11.2	4.8	
PILA	sugar pine	42%	13.3	10.4	
PSME	Douglas-fir	100%	49.6	25.0	
THPL	western redcedar	28%	10.0	.0	
TSHE	western hemlock	42%	8.3	2.9	
	TOTAL OVERSTORY	100%	78.6	9.9	
ABCO	—CONIFERS— white fir	57%	18.7	10.3	could be confused with western white pine seral slow grower, very tolerant out-competes hemlock on drier sites higher cover on moister sites
CADE3	incense-cedar	57%	8.0	5.7	
PILA	sugar pine	14%	1.0	0	
PSME	Douglas-fir	71%	9.0	8.0	
TABR	Pacific yew	57%	4.3	1.5	
THPL	western redcedar	100%	22.6	13.6	
TSHE	western hemlock	85%	13.0	7.7	
	—HARDWOODS— vine maple	100%	18.0	10.5	potential vegetation management consideration prolific sprouter, competes with conifers potential vegetation management consideration, nitrogen- fixer disturbance indicator, fades from stand around age 100 mast for forage
ACGL	Douglas maple	14%	5.0	0	
ACMA	big-leaf maple	42%	5.0	0	
ALRU	red alder	14%	1.0	0	
ARME	Pacific madrone	28%	4.5	3.5	
CACH	golden chinquapin	28%	14.0	8.5	
	TOTAL UNDERSTORY	100%	84.3	15.3	
BENE	dwarf Oregongrape	85%	9.2	6.3	high productivity indicator drier indicator, productive
CHME	little prince's-pine	28%	1.5	.7	
CHUM	common prince's-pine	42%	1.3	6	
CONU	Pacific dogwood	42%	3.3	.6	
GASH	salal	85%	20.7	16.1	
HODI	creambush ocean-spray	14%	4.0	.0	
RHMA	Pacific rhododendron	71%	24.4	13.4	cool, moist sites drier sites
ROGY	baldhip rose	100%	2.3	1.8	
RUNI	snow bramble	28%	5.5	6.4	
RUPA	thimbleberry	28%	2.0	1.4	
RUUR	Pacific blackberry	71%	2.2	.8	
SYMO	creeping snowberry	57%	1.3	5	
VAME	thin-leaved huckleberry	28%	2.0	1.4	
VAPA	red huckleberry	57%	4.8	3.8	
WHMO	whipplevine	100%	9.0	8.4	
	TOTAL SHRUB	100%	63.7	33.6	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	85%	1.8	1.0	warm, moist indicator
ACRU	baneberry	14%	1.0	.0	
ADBI	trail-plant, pathfinder	71%	3.4	3.8	
ADPE	northern maidenhair	14%	1.0	.0	
ANDE	threeleaf anemone	100%	2.6	2.1	
ARMA3	bigleaf sandwort	14%	1.0	.0	
ASHA	marbled wild ginger	28%	1.5	.7	
CASC2	rough harebell	42%	1.0	.0	
CLUN	queen's cup	42%	1.0	.0	
COLA	cutleaf goldthread	28%	1.0	.0	
COMA3	spotted coral-root	14%	1.0	.0	
CORAL	coral-root	14%	1.0	.0	
DIFO	Pacific bleedingheart	14%	1.0	.0	
DIHOO	Oregon fairybell	100%	1.4	.8	
EBAU	phantom-orchid	14%	1.0	.0	
EQAR	common horsetail	14%	30.0	.0	
FRVEB	woods strawberry	28%	1.5	.7	
GAAP	catchweed bedstraw	71%	1.4	.5	
GATR	fragrant bedstraw	14%	1.0	.0	
GOOB	rattlesnake-plantain	100%	1.0	.0	
HAL	white-fl'd hawkweed	71%	1.8	1.8	
LAPO	leafy peavine	42%	1.3	.6	
LIBOL	western twinflower	85%	8.7	5.3	
LICA3	northwest listera	14%	2.0	.0	
LUCA2	tailcup lupine	14%	1.0	.0	
LYAM	yellow skunk cabbage	14%	30.0	.0	
MAMA	woodland tarweed	14%	1.0	.0	
MOUN2	Indian-pipe	14%	1.0	.0	
MOSI	candyflower	14%	1.0	.0	
OSCH	mountain sweet-root	42%	1.0	.0	
OXOR	Oregon oxalis	14%	10.0	.0	
POMU	western sword-fern	57%	1.8	1.0	
PTAQ	bracken	28%	1.5	.7	
PYAP	leafless pyrola	14%	1.0	.0	
PYPI	whitevein pyrola	28%	1.5	.7	
SEBO	Bohlander's groundsel	14%	1.0	.0	
SMRA	western false Solomon's-seal	28%	1.0	.0	
SMST	starry false Solomon's-seal	57%	1.5	1.0	
SYRE	snow-queen	42%	1.3	.6	
TITR	foamflower	14%	2.0	.0	
TRLA2	western starflower	71%	1.2	.4	
TROV	white trillium	100%	1.1	.4	
VAHE	white inside-out-flr	28%	1.0	.0	
VEVI	American false hellebore	14%	1.0	.0	
VIAM	American vetch	28%	2.5	.7	
VIGL	stream violet	42%	2.7	2.1	
VIOR2	round-leaved violet	57%	2.5	1.7	
	TOTAL HERB	100%	42.9	29.3	
BRPA	Pacific brome	28%	1.5	.7	
BRVU	Columbia brome	14%	1.0	.0	
CAREX	sedge spp.	14%	1.0	.0	
FEOC	western fescue	14%	1.0	.0	
FESU	bearded fescue	28%	1.0	.0	
	TOTAL GRASS	100%	1.4	1.3	

## WHITE FIR SERIES

*Abies concolor*

ABCO

The White Fir Series is the most widespread, the most diverse, and one of the most productive. It offers a variety of management options, in timber production, wildlife, forage, and recreation. All of the area's major tree species are found in the Series, from Alaska-cedar, mountain hemlock and Shasta red fir, characteristic of cooler sites, to ponderosa pine and Oregon white oak, characteristic of warmer, drier sites. Over 90 shrub and herb species are common associates. Dwarf Oregongrape, baldhip rose, common prince's-pine, and Pacific blackberry are the most common. Eighteen Plant Associations have been identified in the Cascade Province.

Grand fir (*Abies grandis*) also occurs in the area, but it interbreeds with white fir and is difficult to distinguish. Zobel (1973, 1974, 1975) has described a zone of morphological and physiological intergradation between the two species. The overlap occurs in a diagonal band extending from the Klamath Mountain Province (northwest California and southwest Oregon) through the southern Oregon Cascades into the Blue Mountains (northeast Oregon and west-central Idaho). Individuals exhibiting characteristics of both species are often referred to as *Abies grandicolor* (sic). All references in this guide will be to white fir (*A. concolor*) although some individuals in the field may appear more grand fir-like (*A. grandis*). The ecological and silvicultural differences are not significant enough to warrant any distinctions within the context of this guide.

White fir is an environmentally tolerant species. It occurs on almost 70 percent of all plots collected in the Cascade Mountain Province in an elevational range of 1400-6000 feet. It is competitive on a full range of temperature and moisture regimes (Figure 11). It occupies the middle environmental ground of the southern Oregon Cascades. Western hemlock occurs on warmer, moister sites; Douglas-fir occurs on warmer, drier sites; and Pacific silver fir, Shasta red fir, mountain hemlock, and lodgepole pine occur on cooler sites. It is the major climax species on approximately half of the sites where it occurs and a minor climax on most of the other half.

White fir is extremely susceptible to fungal attacks and rots. Susceptibility increases dramatically after mechanical or fire injury. Silviculturists should consider the potential for scarring or injuring stems during intermediate entries.

### THE SERIES

**EXTENT:** The northern extent of the White Fir Series is the Cascade Mountain Province of southwest Oregon. Since white fir occurs as a climax species within most of its range, the Series extends south through the Sierra and Coast Ranges. The White Fir Series extends to the east (Hopkins 1979) and the northeast (Hall 1973), while Hemstrom et al. (1987) identify grand fir plant associations to the north in the Willamette National Forest.

Within the Cascade Mountain Province, the White Fir Series occurs from Ashland Ranger District north through Tiller and North Umpqua Ranger Districts. There are some scattered occurrences on Cottage Grove and Diamond Lake Ranger Districts. Occurrence of the Series decreases from south to north. N = 178 plots.

**IDENTIFYING CHARACTERISTICS:** Series are defined by the dominant climax species, as indicated by the regeneration layer, since most undisturbed stands are only at mid-seral stage of succession. It is important to thoroughly investigate the site, particularly if it is in early seral condition to determine the Series (see the discussion on keying disturbed sites and the classification concept presented earlier in the guide). Since white fir is one of the most extensive Series in the Cascades, it occurs on a wide variety of sites and in association with most species. White fir consistently dominates the understory tree layer, although western hemlock, Douglas-fir, sugar pine, ponderosa pine, western white pine, Engelmann spruce, western redcedar, lodgepole pine, mountain hemlock, Shasta red fir,

Pacific silver fir, incense-cedar, and Pacific yew may be present in various combinations.

**ABIOTIC ENVIRONMENT:** The White Fir Series is difficult to describe because it is so wide ranging. Averaging its characteristics tends to blur the picture. However, elevation of other true fir Series (Shasta red and Pacific silver) and mountain hem-

lock and lodgepole pine is higher; while western hemlock, western redcedar, Douglas-fir, and the oak Series occur at lower elevations.

The Series is found on the steeper topography of the Western Cascade Zone. It occurs on a full range of parent materials: andesite, basalt, pyroclastics, and granitics.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	2100	5650	3550	4072.0	825.0	
Aspect (deg)	-	-	-	248.6	108.3	
Slope (%)	0	85	85	27.8	19.3	
Total soil depth (in)	4.7	50.0	45.3	41.1	12.2	
Rooting depth (in)	17.7	51.2	33.5	46.1	8.3	
Total basal area (ft <sup>2</sup> /ac)	80	640	560	290.1	91.0	

**CLIMATE:** Relative to the Cascade Province, the Series is moderate to dry in terms of mean annual

precipitation and moderate to cool in terms of mean annual temperature (Figure XX).

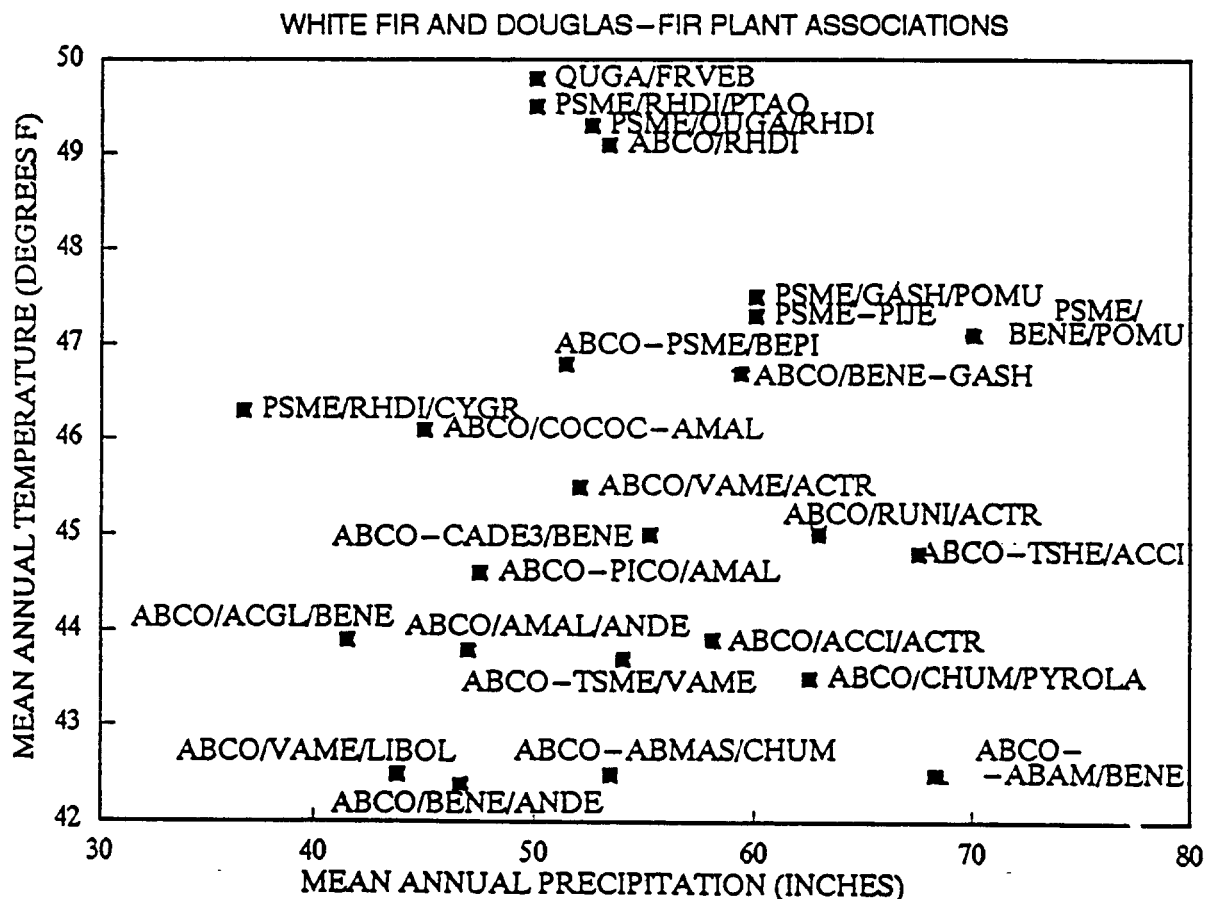


Figure 11. Ecograph of White Fir and Douglas-fir Plant Associations

CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	40.6	50.2	9.6	44.6	2.2	
Maximum month temp (F)	72.0	86.2	14.2	78.3	3.3	
Mean annual ppt (in)	30	80	50	53.5	10.9	
Dry season ppt (in)	6	11	5	7.5	1.3	

**FOREST FLOOR:** The forest floor condition is indicative of the climate. Cool to moderate tempera-

tures and low to moderate precipitation limit moss growth and litter decomposition.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	50	100	50	93.2	9.0	
Moss (%)	0	80	80	8.3	14.5	
Bareground (%)	0	20	20	1.6	3.2	
Gravel (%)	0	50	50	1.5	5.0	
Rock (%)	0	80	80	3.9	8.0	
Bedrock (%)	0	10	10	3	1.4	

**VEGETATION:** White Fir Series is contiguous with virtually all other Series in the southern Oregon Cascades. Several associations are identified in this guide where white fir is a co-climax species with other conifers. Lodgepole pine, mountain and western hemlock, Shasta red and Pacific silver fir, and Douglas-fir all occur as co-climax species with white fir in the environmental transition between the Series. White fir is most commonly found regenerating under stands of Douglas-fir, incense-cedar, and sugar pine.

There are about 90 tree and shrub species which commonly occur in the Cascade Mountain Province. Over 80 percent of them are represented in the White Fir Series. (See the constancy values in the vegetation table below).

**SILVICULTURE:** White Fir Series is one of the most productive in the Cascades. The average above ground biomass is about the same as the entire Cascade data set. The White Fir Series represents one-third of the classification, and more than that in terms of acreages. Only the Western Hemlock Series is more productive in terms of biomass production and area involved.

The extreme range of environmental characteristics occurring in the Series create regeneration opportunities involving a wide variety of species. The most common commercial species include: white fir, Douglas-fir, incense-cedar, sugar and western white pines, Shasta red fir, and ponderosa pine. A mixture of species, fine-tuned to site specific char-

acteristics will maximize biomass and other productivity measures. Several hardwood species will show good growth characteristics where non-timber values are desired: golden chinquapin, vine maple, and Rocky Mountain maple.

Natural regeneration is an important management tool on these sites. All of the above species should be considered in reforestation plans, especially where partial cut harvest systems are employed. The most significant regeneration problems to be considered are frost potential and animal damage. The Dead Indian Plateau, for example, has numerous examples of gopher damage in areas where gopher populations had been minimal prior to commercial entry. In the same zone, the potential for frost damage is high. In stands where the shelterwood was removed after 15 years, bud damage was observed at 12 high on boles of small trees.

Vegetation management will have to be analyzed in some white fir associations. The most common species which will indicate vegetation management concerns are: creambush ocean-spray, trailing blackberry, Pacific madrone, golden chinquapin, maple, and particularly manzanita and ceanothus.

Stand density management is an important tool, especially in mixed species stands. Desired stand density management objectives would be to remove white fir in the initial entries, reducing the probability of mechanical damage to white fir crop trees. Use of other species or widely scattered white fir as crop trees will ensure quality fiber production.

Where the desired product is wildlife habitat or biomass recycling, a less aggressive management stance would be appropriate.

**WATERSHED MANAGEMENT:** Because this Series represents one-third of the classification and probably a higher proportion of the land area, water quality and quantity produced by these forested lands is a significant fraction of the total yield. Management of white fir associations for water production and soil stability is significant.

Average slope steepness is 28 percent with maximums around 85 percent. The slopes are characteristic of the Western Cascade Zone. Soils are derived primarily from basalts and andesites, and are sometimes overlain with Mehama or Mazama pyroclastics. Erosion potential is most significant on skeletal soils; which can be andesite, basalt, or granite.

**FIRE MANAGEMENT:** The White Fir Series occupies a broad spectrum of environments. Fire occurrence ranges from frequent, low intensity fires to less frequent, higher intensity. Forty-four percent of the sampled stands had evidence of being burned. Low intensity underburning was more evident in the associations at the drier, warmer end of the Series while a higher intensity, less frequent fire regime is common in the colder, wetter associations.

Juvenile white fir is susceptible to fire. In later maturity, when the trees are greater than 20 inches in diameter, the bark becomes thick enough to protect the cambium from lethal temperatures during low or moderate intensity fires. In mature stands, seedlings and saplings provide a fuel ladder to the canopy. Ponderosa pine, western white pine, sugar pine, incense-cedar, and Douglas-fir are the early seral species that pioneer after disturbances such as fire.

Fires are more frequent in low elevation zones where fuel moistures are low during the summer. Lightning starts are significant throughout the zone. Biomass production leads to sufficient fuels for carrying fires, either through shrub/herb or fuel loadings from tree attrition.

**RANGE AND WILDLIFE MANAGEMENT:** Shrub and herb cover average 51 percent and 47 percent, respectively, an indication that both browse and forage production are potentially high. A variety of browse species such as California hazel, Pacific dogwood, creambush ocean-spray, red huckleberry, dwarf bramble, black raspberry, snow bramble, thimbleberry, salmonberry, and Pacific blackberry are scattered through the stands in varying amounts. Grass cover is 2 percent, less than average for the Cascade province.

Wildlife habitat is richly diverse by mid-seral stage. The combination of tolerant and intolerant conifers and hardwoods provide structural and compositional diversity. Openings with shrubs and patches of regeneration commonly provide hiding cover. Snags and down logs are commonly scattered throughout the stands. Scattered old growth Douglas-fir, white fir, sugar pine, ponderosa pine, and other survivors of previous fires provide old growth components.

**RECREATION AND VISUAL MANAGEMENT:** Generally these mid-elevation associations do not have distinctive recreational or visual features. They are of average slope (28 percent) and somewhat brushy, so walking through can be arduous. Poison oak occurs in the drier associations and armed plants on the higher elevation associations.



MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	2%	2	6	4	3.5	1.7	
ABCO	white fir	63%	2	70	68	26.3	16.7	
ABMAS	Shasta red fir	16%	1	53	52	15.8	13.4	
CADE3	incense-cedar	32%	2	35	33	12.4	8.8	
PIEN	Engelmann spruce	2%	2	25	23	11.0	11.2	
PIAT	knobcone pine	0%	10	10	0	10.0	.0	
PICO	lodgepole pine	1%	18	52	34	33.3	17.2	
PILA	sugar pine	27%	1	20	19	7.1	4.5	
PIMO	western white pine	18%	1	25	24	7.7	5.7	
PIPO	ponderosa pine	17%	1	80	79	11.3	17.3	
PSME	Douglas-fir	92%	4	90	86	38.1	22.4	
THPL	western redcedar	0%	4	4	0	4.0	.0	
TSHE	western hemlock	1%	5	10	5	7.5	3.5	
TSME	mountain hemlock	3%	1	35	34	11.3	11.4	
	TOTAL OVERSTORY	100%	22	100	78	65.7	15.6	
	—CONIFERS—							
ABAM	Pacific silver fir	7%	1	40	39	11.3	12.3	
ABCO	white fir	96%	1	110	109	30.0	18.5	
ABMAS	Shasta red fir	11%	1	40	39	12.6	10.3	
CADE3	incense-cedar	53%	1	30	29	9.6	7.5	
PIEN	Engelmann spruce	2%	1	8	7	3.0	2.9	
PICO	lodgepole pine	2%	12	25	13	18.2	6.7	
PILA	sugar pine	15%	1	10	9	3.0	2.6	
PIMO	western white pine	15%	1	15	14	3.2	2.8	
PIPO	ponderosa pine	5%	2	30	28	7.0	8.3	
PSME	Douglas-fir	62%	1	70	69	12.8	11.0	
TABR	Pacific yew	23%	1	58	57	16.4	16.5	
THPL	western redcedar	1%	8	12	4	10.0	2.8	
TSHE	western hemlock	14%	1	25	24	9.3	7.6	
TSME	mountain hemlock	8%	1	34	33	8.7	9.0	
	—HARDWOODS—							
ACCI	vine maple	18%	1	110	109	34.9	31.6	
ACGL	Douglas maple	13%	1	15	14	5.0	4.0	
ACMA	big-leaf maple	7%	1	35	34	11.8	10.4	
ALRU	red alder	0%	1	1	0	1.0	.0	
ARME	Pacific madrone	16%	1	25	24	7.6	5.9	
CACH	golden chinquapin	51%	1	75	74	10.4	14.3	
PREM	bittercherry	0%	2	2	0	2.0	.0	
QUCH	canyon live oak	2%	1	8	7	3.5	3.1	
QUKE	California black oak	3%	2	15	13	5.3	4.9	
	TOTAL UNDERSTORY	100%	10	168	158	66.8	26.9	

MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
AMAL	western serviceberry	27%	1	109	108	8.0	16.7	
ARCO3	hairy manzanita	0%	1	1	0	1.0	.0	
ARNE	pinemat manzanita	1%	2	15	13	8.3	6.5	
ARPA	greenleaf manzanita	1%	1	3	2	2.0	1.4	
BENE	dwarf Oregongrape	82%	1	95	94	11.9	14.1	
BEPI	Piper's Oregongrape	23%	1	15	14	4.3	3.7	
CEIN	deerbrush	3%	1	3	2	2.1	.9	
CEPR	squaw carpet	0%	20	23	0	23.0	.0	
CEVE	snowbrush	1%	1	2	1	1.5	.7	
CHME	little prince's-pine	19%	1	12	11	1.5	1.9	
CHUM	common prince's-pine	68%	1	50	49	7.5	9.3	
CHVI	green rabbit-brush	0%	5	5	0	5.0	.0	
CONU	Pacific dogwood	20%	1	25	24	7.5	7.1	
COST	red-osier dogwood	2%	1	2	1	1.3	.5	
COCOC	California hazel	41%	1	60	59	8.2	10.3	
GAFR	Fremont silk-tassel	1%	2	5	3	3.3	1.5	
GAOV	slender salal	3%	1	3	2	1.8	.8	
GASH	salal	10%	1	95	94	38.2	34.3	
HODI	creambush ocean-spray	31%	1	60	59	8.2	10.8	
LONIC	honeysuckle spp.	0%	1	1	0	1.0	.0	
LOCI	trumpet honeysuckle	6%	1	3	2	1.5	.7	
LOHI	hairy honeysuckle	6%	1	4	3	1.6	1.0	
OECE	Indian plum	1%	1	4	3	2.5	2.1	
PAMY	Oregon boxwood	32%	1	15	14	2.8	2.9	
PHCA3	Pacific ninebark	0%	1	1	0	1.0	.0	
RHPU	cascara	2%	1	8	7	2.8	3.5	
RHMA	Pacific rhododendron	9%	1	100	99	19.9	26.0	
RHDI	poison oak	5%	1	15	14	4.8	4.5	
RIBES	currant spp.	10%	1	10	9	2.9	2.3	
RIBI	Siskiyou gooseberry	2%	1	2	1	1.5	.6	
RICE	squaw currant	1%	1	7	6	3.7	3.1	
RIER	Crater Lake currant	0%	2	2	0	2.0	.0	
RILA	swamp gooseberry	6%	1	10	9	3.6	3.2	
RILO	gummy gooseberry	6%	1	15	14	3.4	3.9	
RIVI	sticky currant	7%	1	15	14	4.8	4.4	
ROGY	baldhip rose	84%	1	20	19	3.5	2.8	
RULA	dwarf bramble	12%	1	25	24	3.3	5.7	
RULE	black raspberry	1%	1	2	1	1.5	.7	
RUNI	snow bramble	11%	1	8	7	2.7	2.2	
RUPA	thimbleberry	16%	1	12	11	2.6	2.6	
RUSP	salmonberry	1%	1	1	0	1.0	.0	
RUUR	Pacific blackberry	69%	1	25	24	3.4	3.1	
SALIX	willow spp.	2%	1	5	4	2.5	1.7	
SOSI	Sitka mountain-ash	3%	1	2	1	1.3	.5	
SYAL	common snowberry	8%	1	8	7	3.0	2.4	
SYMO	creeping snowberry	63%	1	30	29	4.4	4.7	
VAME	thin-leaved huckleberry	31%	1	100	99	13.7	21.3	
VAPA	red huckleberry	4%	1	5	4	2.8	1.8	
VASC	grouse huckleberry	1%	1	2	1	1.5	.7	
WHMO	whipplevine	40%	1	30	29	6.3	5.2	
	TOTAL SHRUB	100%	2	175	173	51.3	33.5	

- MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ACMI	common yarrow	1%	1	1	0	1.0	.0	
ACTR	vanilla leaf	47%	1	75	74	12.2	15.6	
ACRU	baneberry	4%	1	8	7	3.3	3.0	
ADBI	trail-plant, pathfinder	64%	1	20	19	3.2	3.5	
ADCA	Venus-hair fern	0%	1	1	0	1.0	.0	
AGUR	nettle-leaf horse-mint	1%	1	1	0	1.0	.0	
ALVI	candystick	1%	1	2	1	1.5	.7	
ANMA	common pearly-everlasting	1%	2	3	1	2.5	.7	
ANDE	threeleaf anemone	72%	1	12	11	2.4	1.9	
ANLY2	Lyall anemone	7%	1	4	3	1.4	.9	
APAN	spreading dogbane	6%	1	2	1	1.2	.4	
AQFO	Sitka columbine	1%	1	1	0	1.0	.0	
ARMA3	bigleaf sandwort	42%	1	15	14	1.9	2.0	
ARCO	heart-leaf arnica	3%	1	60	59	12.3	23.4	
ARLA	mountain arnica	7%	1	12	11	3.5	4.0	
ASCA3	western wild ginger	18%	1	15	14	2.9	3.5	
ASHA	marbled wild ginger	9%	1	4	3	2.0	1.0	
ASTR	maidenhair spleenwort	0%	2	2	0	2.0	.0	
ASTER		1%	1	2	1	1.5	.7	
BADE	Puget balsamroot	0%	2	2	0	2.0	.0	
BORAG		0%	3	3	0	3.0	.0	
CATO	Tolmie's mariposa	0%	1	1	0	1.0	.0	
CABU2	fairy-slipper	7%	1	1	0	1.0	.0	
CAPR3	California harebell	9%	1	4	3	1.5	1.0	
CASC2	rough harebell	45%	1	15	14	2.1	2.2	
CARDA		0%	1	1	0	1.0	.0	
CAPUP	purple reedgrass	0%	1	1	0	1.0	.0	
CASTI		0%	1	1	0	1.0	.0	
CIAL	alpine circaea	0%	1	1	0	1.0	.0	
CIRSI		1%	1	1	0	1.0	.0	
CLUN	queen's cup	43%	1	15	14	3.0	2.8	
COHE	varied-leaved collomia	4%	1	2	1	1.1	.3	
COLA	cutleaf goldthread	1%	1	5	4	3.0	2.8	
CORAL	coral-root	1%	1	1	0	1.0	.0	
COMA3	spotted coral-root	12%	1	1	0	1.0	.0	
COME	Pacific coral-root	4%	1	1	0	1.0	.0	
COST2	hooded coral-root	12%	1	2	1	1.0	.2	
COCA	bunchberry	1%	1	10	9	4.0	5.2	
CYGR	Pacific hound's-tongue	3%	1	10	9	3.3	3.9	
DELPH		1%	1	2	1	1.7	.6	
DETR	Columbia River larkspur	0%	1	1	0	1.0	.0	
DIFO	Pacific bleedingheart	7%	1	2	1	1.1	.3	
DIHOO	Oregon fairybell	58%	1	23	22	1.9	2.6	
EBAU	phantom-orchid	3%	1	1	0	1.0	.0	
EPAN	fireweed	0%	1	1	0	1.0	.0	
EPMI	small-fl'd willow-herb	0%	1	1	0	1.0	.0	
ERAL	Alice fleabane	0%	3	3	0	3.0	.0	
FRVEB	woods strawberry	47%	1	15	14	2.5	2.5	
GAAP	catchweed bedstraw	55%	1	8	7	1.3	.9	
GAOR	Oregon bedstraw	8%	1	4	3	1.8	.9	
GATR	fragrant bedstraw	1%	1	2	1	1.5	.7	
GOOB	rattlesnake-plantain	63%	1	5	4	1.1	.4	
HABEN		0%	1	1	0	1.0	.0	
HAUN	Alaska bog-orchid	0%	1	1	0	1.0	.0	
HACA	large-fl'd goldenweed	0%	1	1	0	1.0	.0	
HEUCH		0%	1	1	0	1.0	.0	
HEMI	smallflower alumroot	3%	1	2	1	1.2	.4	
HIAL	white-flowered hawkweed	58%	1	5	4	1.5	.8	
HORKE		0%	2	2	0	2.0	.0	
HYPE	Klamath weed	0%	1	1	0	1.0	.0	
IRIS	iris spp.	6%	1	2	1	1.1	.3	
IRCH	slender-tubed iris	2%	1	1	0	1.0	.0	
IRTEK	Oregon iris	0%	1	1	0	1.0	.0	
LAPO	leafy peavine	21%	1	35	34	5.5	7.5	
LIAP	celery-ld licorice-rt	1%	1	2	1	1.5	.7	

LICO4	tiger lily	1%	1	1	0	1.0	.0
LWA	Washington lily	2%	1	1	0	1.0	.0
LIBOL	western twinflower	65%	1	80	79	16.4	20.6
LICA3	northwest listera	6%	1	1	0	1.0	.0
LOMAT		0%	1	1	0	1.0	.0
LUPIN	lupine spp.	2%	1	8	7	4.8	3.8
LUAL	sickle-keeled lupine	1%	1	2	1	1.5	.7
LUBI	two-colored lupine	0%	5	5	0	5.0	.0
LUCA	tailcup lupine	0%	1	1	0	1.0	.0
MAMA	woodland tarweed	7%	1	2	1	1.1	.3
MECA2	Idaho bluebells	0%	1	1	0	1.0	.0
MECI	ciliate bluebells	1%	1	5	4	3.0	2.8
MITEL		0%	1	1	0	1.0	.0
MITR2	three-tooth mitrewort	13%	1	3	2	1.3	.6
MOUN2	Indian-pipe	0%	1	1	0	1.0	.0
MOPE	miner's lettuce	0%	1	1	0	1.0	.0
MOSI	candyflower	17%	1	15	14	1.9	2.6
MOSIS	candyflower	1%	1	2	1	1.5	.7
NEHE	small white nemophila	9%	1	2	1	1.1	.2
ORPU	dwarf owl-clover	0%	1	1	0	1.0	.0
OSCH	mountain sweet-root	48%	1	10	9	1.7	1.4
PERA	leafy lousewort	13%	1	5	4	1.3	.9
PESP	royal penstemon	0%	1	1	0	1.0	.0
PHACE		1%	1	1	0	1.0	.0
PHHA	whiteleaf phacelia	1%	1	1	0	1.0	.0
PHNE	woodland phacelia	0%	1	1	0	1.0	.0
PHAD	woodland phlox	9%	1	3	2	1.2	.5
PHSP	showy phlox	0%	3	3	0	3.0	.0
POMU	western sword-fern	24%	1	10	9	2.6	2.1
POTEN		0%	5	5	0	5.0	.0
POGL	sticky cinquefoil	0%	1	1	0	1.0	.0
PSPH	California-tea	0%	1	1	0	1.0	.0
PTAQ	bracken	28%	1	30	29	3.0	4.4
PTAN	woodland pinedrops	1%	1	1	0	1.0	.0
PYAP	leafless pyrola	8%	1	1	0	1.0	.0
PYAS	alpine pyrola	0%	1	1	0	1.0	.0
PYPI	whitevein pyrola	26%	1	3	2	1.1	.4
PYSE	one-sided pyrola	29%	1	7	6	1.4	1.2
RUDBE		0%	2	2	0	2.0	.0
RUAC	sheep sorrel	0%	1	1	0	1.0	.0
SADO	yerba buena	8%	1	12	11	2.1	2.8
SIDAL		0%	1	1	0	1.0	.0
SIHO	Hooker's silene	0%	1	1	0	1.0	.0
SMRA	western false Solomon's-seal	13%	1	2	1	1.1	.3
SMST	starry false Solomon's-seal	48%	1	15	14	3.0	2.5
SYRE	snow-queen	44%	1	10	9	2.0	1.5
THMO	mountain thermopsis	1%	1	5	4	3.0	2.8
TITR	foamflower	14%	1	12	11	2.9	2.9
TRLA2	western starflower	76%	1	15	14	2.4	2.0
TROV	white trillium	48%	1	8	7	1.4	1.0
VASI	mountain heliotrope	1%	1	5	4	2.3	2.3
VAHE	white inside-out-flr	62%	1	40	39	3.4	4.9
VECA	Calif. false hellebore	8%	1	2	1	1.1	.4
VETH	common mullein	0%	1	1	0	1.0	.0
VERON		0%	1	1	0	1.0	.0
VIAM	American vetch	17%	1	20	19	2.7	3.6
VIAD	early blue violet	3%	1	2	1	1.3	.5
VIGL	stream violet	39%	1	30	29	2.1	3.6
VIHA	Hall's violet	0%	2	2	0	2.0	.0
VINU	Nuttall's violet	0%	1	1	0	1.0	.0
VIOR2	round-leaved violet	23%	1	7	9	1.7	1.5
XETE	common beargrass	6%	1	8	7	3.7	2.2
	TOTAL HERB	100%	3	198	195	47.1	32.1

BROMU	brome spp.	2%	1	5	4	2.0	1.7
BRER	meadow brome	1%	1	3	2	2.0	1.4
BRPA	Pacific brome	33%	1	15	14	2.0	2.3
BRVU	Columbia brome	1%	1	4	3	2.0	1.7
CAREX	sedge spp.	7%	1	10	9	2.2	2.4
CARO	Ross sedge	0%	1	1	0	1.0	0
CYEC	hedgehog dogtail	1%	1	1	0	1.0	.0
ELYMU	wildrye spp.	0%	1	1	0	1.0	0
ELGL	blue wildrye	1%	1	2	1	1.3	.6
FESTU	fescue spp.	1%	1	2	1	1.3	.6
FEID	Idaho fescue	1%	1	1	0	1.0	.0
FEOC	western fescue	27%	1	5	4	1.4	.9
FERU	red fescue	2%	1	2	1	1.2	.4
HOLA	common velvet-grass	0%	1	1	0	1.0	.0
LUCA2	tailcup lupine	1%	1	1	0	1.0	.0
LUHI	smooth woodrush	1%	1	1	0	1.0	.0
MEHA	Harford's melic	1%	1	4	3	2.5	2.1
MESU	Alaska oniongrass	18%	1	4	3	1.5	.8
	TOTAL GRASS	100%	0	16	16	1.9	2.2

## WHITE FIR KEY

1a	Poison oak [RHDI] present <i>and</i> Piper's Oregongrape [BEPI] absent.	ABCO/RHDI
1b	Poison oak [RHDI] absent <i>or</i> poison oak present with Piper's Oregongrape [BEPI] present.	2
2a	Lodgepole pine [PICO] present.	ABCO-PICO/AMAL
2b	Lodgepole pine [PICO] absent.	3
3a	Pacific silver fir [ABAM] present.	4
3b	Pacific silver fir [ABAM] absent.	5
4a	Western hemlock [TSHE] present.	ABCO-TSHE/ACCI
4b	Western hemlock [TSHE] absent.	ABCO-ABAM/BENE
5a	Shasta red fir [ABMAS] present.	ABCO-ABMAS/ CHUM
5b	Shasta red fir [ABMAS] absent.	6
6a	Mountain hemlock [TSME] present.	ABCO-TSME/VAME
6b	Mountain hemlock [TSME] absent.	7
a	Salal [GASH] with more than 10% cover <i>or</i> Pacific rhododendron [RHMA] with more than 10% cover.	ABCO/BENE-GASH
7b	Salal [GASH] absent <i>or</i> minor (less than 10% cover) <i>and</i> Pacific rhododendron [RHMA] absent <i>or</i> minor (less than 10% cover).	8
8a	California black oak [QUKE] present.	ABCO/COCOC- AMAL
8b	California black oak [QUKE] absent.	9
9a	Thin-leaved huckleberry [VAME] <i>and</i> Pacific yew [TABR] present, vanillaleaf [ACTR] absent.	ABCO/VAME/LIBOL
9b	Thin-leaved huckleberry [VAME] <i>or</i> Pacific yew [TABR] absent, if both present then vanillaleaf [ACTR] present also.	10
10a	Snow bramble [RUNI] present <i>and</i> vine maple [ACCI] absent <i>or</i> minor (less than 5% cover).	ABCO/RUNI/ACTR
10b	Snow bramble [RUNI] absent <i>or</i> snow bramble present with vine maple [ACCI] with more than 5% cover.	11

11a	Vine maple [ACCI] with more than 10% cover <i>and</i> vanillaleaf [ACTR] present, usually with more than 5% cover. Oregon boxwood [PAMY] absent and catchweed bedstraw [GAAP] usually present.	ABCO/ACCI/ACTR
11b	Vine maple [ACCI] absent or minor (less than 10% cover) <i>or</i> vanillaleaf [ACTR] not as described above.	12
12a	Thin-leaved huckleberry [VAME] present <i>and</i> Oregon boxwood [PAMY] or Pacific yew [TABR] present.	ABCO/VAME/ACTR
12	Thin-leaved huckleberry [VAME] absent, or thin-leaved huckleberry present with Oregon boxwood [PAMY] <i>and</i> Pacific yew [TABR] absent.	13
13a	Rocky Mountain maple [ACGL] present <i>and</i> Oregon boxwood [PAMY] absent.	ABCO/ACGL/BENE
13b	Rocky Mountain maple [ACGL] absent, or Rocky Mountain maple present with Oregon boxwood [PAMY] present.	14
14a	Western serviceberry [AMAL] <i>and</i> Oregon boxwood [PAMY] present.	ABCO/AMAL/ANDE
14b	Western serviceberry [AMAL] <i>or</i> Oregon boxwood [PAMY] absent.	15
15a	Piper's Oregongrape [BEPI] present.	ABCO-PSME/BEPI
15b	Piper's Oregongrape [BEPI] absent.	16
16a	Incense-cedar [CADE3] present.	ABCO-CADE3/BENE
16b	Incense-cedar [CADE3] absent.	17
17a	Western prince's-pine [CHUM] with more than 10% cover.	ABCO/CHUM/ PYROLA
17b	Western prince's-pine [CHUM] absent or minor (less than 10% cover).	ABCO/BENE/ANDE

## WHITE FIR ASSOCIATIONS

ABCO-PICO/AMAL pg. 216	White fir - Lodgepole pine / Western serviceberry <i>Abies concolor</i> - <i>Pinus contorta</i> / <i>Amelanchier alnifolia</i>
ABCO-TSME/LIBOL pg. 220	White fir - Mountain hemlock / Twinflower <i>Abies concolor</i> - <i>Tsuga mertensiana</i> / <i>Linnaea borealis longiflora</i>
ABCO-ABMAS/ CHUM pg. 224	White fir - Shasta red fir / Common prince's-pine <i>Abies concolor</i> - <i>Abies magnifica shastensis</i> / <i>Chimaphila umbellata</i>
ABCO-ABAM/BENE pg. 230	White fir - Pacific silver fir / Dwarf Oregongrape <i>Abies concolor</i> - <i>Abies amabilis</i> / <i>Berberis nervosa</i>
ABCO-TSHE/ACCI pg. 236	White fir - Western hemlock / Vine maple <i>Abies concolor</i> - <i>Tsuga heterophylla</i> / <i>Acer circinatum</i>
ABCO/RUNI/ACTR pg. 240	White fir / Snow bramble / Vanillaleaf <i>Abies concolor</i> / <i>Rubus nivalis</i> / <i>Achlys triphylla</i>
ABCO/VAME/ACTR pg. 244	White fir / Thin-leaved huckleberry / Vanillaleaf <i>Abies concolor</i> / <i>Vaccinium membranaceum</i> / <i>Achlys triphylla</i>
ABCO/VAME/LIBOL pg. 248	White fir / Thin-leaved huckleberry / Western twinflower <i>Abies concolor</i> / <i>Vaccinium membranaceum</i> / <i>Linnaea borealis longiflora</i>
ABCO/ACCI/ACTR pg. 252	White fir / Vine maple / Vanillaleaf <i>Abies concolor</i> / <i>Acer circinatum</i> / <i>Achlys triphylla</i>
ABCO/BENE-GASH pg. 256	White fir / Dwarf Oregongrape - Salal <i>Abies concolor</i> / <i>Berberis nervosa</i> - <i>Gaultheria shallon</i>
ABCO/ACGL/BENE pg. 260	White fir / Douglas maple / Dwarf Oregongrape <i>Abies concolor</i> / <i>Acer glabrum</i> / <i>Berberis nervosa</i>
ABCO/AMAL/ANDE pg. 264	White fir / Western serviceberry / Threelaf anemone <i>Abies concolor</i> / <i>Amelanchier alnifolia</i> / <i>Anemone deltoidea</i>
ABCO/BENE/ANDE pg. 268	White fir / Dwarf Oregongrape / Threelaf anemone <i>Abies concolor</i> / <i>Berberis nervosa</i> / <i>Anemone deltoidea</i>
ABCO/CHUM/ PYROLA pg. 272	White fir / Common prince's-pine / Pyrola <i>Abies concolor</i> / <i>Chimaphila umbellata</i> / <i>Pyrola</i>
ABCO/COCOC- AMAL pg. 276	White fir / California hazel - Western serviceberry <i>Abies concolor</i> / <i>Corylus cornuta californica</i> / <i>Amelanchier alnifolia</i>
ABCO/RHDI pg. 280	White fir / Poison Oak <i>Abies concolor</i> / <i>Rhus diversiloba</i>



# WHITE FIR ASSOCIATIONS (continued)

ABCO-CADE3/BENE pg. 284	White fir - Incense-cedar / Dwarf Oregongrape <i>Abies concolor</i> - <i>Calocedrus decurrens</i> / <i>Berberis nervosa</i>
ABCO-PSME/BEPI pg. 289	White fir - Douglas-fir / Piper's Oregongrape <i>Abies concolor</i> - <i>Pseudotsuga menziesii</i> / <i>Berberis piperiana</i>

**WHITE FIR - LODGEPOLE PINE / WESTERN SERVICEBERRY**  
*Abies concolor* - *Pinus contorta* / *Amelanchier alnifolia*  
**ABCO-PICO/AMAL**

**EXTENT:** ABCO-PICO/AMAL occurs in the Pumice zone of High Cascades, Rogue River National Forest. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** White fir and lodgepole pine are present (the only white fir association with lodgepole pine present); mountain hemlock is absent. Western serviceberry is present. ABCO-PICO/AMAL is most similar to PICO/ARNE, but white fir regeneration dominates over lodgepole pine and western serviceberry (AMAL) is present.

**ABIOTIC ENVIRONMENT:** This Association is found above 3700 feet on broad flats or benches. Water-deposited pyroclastic material overlies buried andesite-basalt profiles, usually in broad valley floors. The pumice-ash deposits are of varying depths, increasing to the north as the distance to Crater Lake decreases, although the soil depths are the shallowest of the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4085.0	544.0
Aspect (deg)	253.0	55.3
Slope (%)	2.3	.5
Total soil depth (in)	32.9	15.2
Rooting depth (in)	39.65	14.8
Total basal area (ft <sup>2</sup> /ac)	130.0	41.6

**CLIMATE:** A combination of several features gives these sites a strong likelihood of frost occurrence: (1) shallow slopes which tend to trap cold air, (2) extensive drainages for collecting cold air, and (3) characteristically low organic matter content of pyroclastic soil horizons (see the discussion on pumice/ash soil in the subprovince descriptions). However, litter cover (94.5 percent) is greater than the mean for the Cascade Province (90.5 percent) because of the slower decomposition rates in the cooler climates associated with ABCO-PICO/AMAL and the above average rate of needle drop, branch drop and mortality from intolerant lodgepole pine. The occurrence of frost during the growing season is the most limiting factor for survival and regeneration. Moisture is also a limiting factor, but not until later in the growing season; and becomes less sig-

nificant when the rooting depth reaches the buried profile (see the High Cascades sub-province description).

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.6	1.4
Maximum month temp (F)	78.3	34.2
Mean annual ppt (in)	47.5	6.5
Dry season ppt (in)	7.0	.8

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.5	5.2
Moss (%)	3.8	3.4
Bareground (%)	1.5	1.7
Gravel (%)	.5	.6
Rock (%)	3.5	2.4
Bedrock (%)	.0	.0

**VEGETATION:** The occurrence of frost after bud-break and the initiation of growth is detrimental to species survival and their ability to regenerate. Species such as lodgepole, western white, and ponderosa pine are all frost tolerant species (listed in order of decreasing tolerance). These three species are seral and will initially invade a disturbed site. White fir and Douglas-fir successfully regenerate when protected from frost by a canopy of pines. The repeated occurrence of frost destines lodgepole pine to be a component of the vegetation in all seral conditions. It is relegated to an understory role in later seral conditions, but will always be a stand component. White fir is the major dominant species in a climax stand, although some sugar pine and golden chinquapin may be found occasionally.

**SILVICULTURE:** Timber management opportunities on these sites are marginal because of frost. Regeneration can be difficult, particularly if the wrong combination of species and harvest systems are employed. The probability of reforestation success is diminished significantly when species such as white fir and Douglas-fir are used. The three pine

species listed above are most appropriate for reforestation, particularly in clearcut situations. Other alternatives include careful use of shelterwood systems or uneven-aged management. The objective with any of the harvest systems is to maintain a canopy which will help to break up cold air pockets and protect the regeneration from killing frosts. The Rogue River National Forest frost committee is exploring specific methods to deal with frost, and will have quantified guides within a year. Since frost depth can be extreme, especially on sites on or near the Dead Indian Plateau, maintenance of the over-story canopy is critical. Advanced natural regeneration should be used if possible.

**ABCO-PICO/AMAL** has the lowest total basal area (less than 50 percent of the Series mean) and the lowest biomass production for the Series. However, biomass production in this Association is 50 percent greater than the Lodgepole Pine Series. Therefore, some of the most adverse growing conditions which are found where lodgepole pine occurs without white fir have been ameliorated. Volume production is maximized when the roots reach the buried soil profile.

Long-stolon sedge forms a dense mat after site preparation or burning, making reforestation difficult. Sedge was found on half of the plots; since long-stolon sedge responds vigorously to mechanical soil disturbance these activities should be avoided if it is found on site.

**WATERSHED MANAGEMENT:** Average annual precipitation varies from approximately 35 inches (Ashland Ranger District) to 60 inches (Butte Falls and Prospect Ranger Districts). Less than 20 percent of the rainfall occurs during the dry season (May-September). And a small percentage of the

wet season precipitation is wet snow, which melts quickly.

Pumice soils generally have high infiltration and percolation rates and overall low water holding capacity. Moreover, erosion potential is low because of the shallow slopes.

**FIRE MANAGEMENT:** Most sites have burned in the last 50-75 years. **ABCO-PICO/AMAL** is the most heavily disturbed plant association in the White Fir Series. These disturbances eliminate white fir in all layers and create opportunities for lodgepole pine regeneration. Natural fire occurrence is moderate to slight because of the topographical position. The low-lying benches are not as lightning prone as the surrounding ridges. However, that same topography is conducive to road locations and opens opportunities for above average man-caused ignitions.

**RANGE & WILDLIFE MANAGEMENT:** The potential for range use is low and the length of the grazing season is relatively short. The Association averages 27 percent cover of herbs and 52 percent cover of shrubs, producing browse and berries. On the flat ground, water sources are not frequent, less than one per half mile. Stands can be diverse in composition and structure, providing patches of hiding cover intermixed with forage and thermal cover.

**RECREATION & VISUAL MANAGEMENT:** These sites are ideal for trail locations: slopes are flat, visibility is high, trail-building is simple. Public access to these areas is high. Specific drawing cards such as prolific wildflowers are not present. Winter is important for cross-country skiing and snowmobiling.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	11.0	1.4	pioneer after disturbance on cold, frost prone sites found on relatively warmer, more protected sites frost tolerant species frost tolerant species least frost tolerant species
PICO	lodgepole pine	75%	33.3	17.2	
PILA	sugar pine	25%	6.0	.0	
PIMO	western white pine	25%	8.0	.0	
PIPO	ponderosa pine	75%	8.3	2.9	
PSME	Douglas-fir	25%	10.0	.0	
	TOTAL OVERSTORY	100%	42.7	15.6	
	—CONIFERS—				
ABCO	white fir	100%	19.2	9.4	requires protection from frost extremely frost tolerant moderately frost tolerant found on cold sites survives when protected from frost
PICO	lodgepole pine	100%	18.2	6.7	
PILA	sugar pine	25%	4.0	.0	
PIMO	western white pine	75%	4.0	1.0	
PIPO	ponderosa pine	50%	4.0	1.4	
PSME	Douglas-fir	75%	11.0	7.9	
	—HARDWOODS—				
CACH	golden chinquapin	50%	4.5	2.1	not tolerant of cold sites
	TOTAL UNDERSTORY	100%	54.0	20.0	
AMAL	western serviceberry	100%	18.5	19.5	pioneer on soils with high coarse fragment content usually found on warmer, drier sites indicates deep, fertile soils indicates drier, less productive sites than BENE warm, dry sites, grows well on pumice indicates moist, cool sites
ARNE	pinemat manzanita	25%	8.0	.0	
ARPA	greenleaf manzanita	25%	3.0	0	
BENE	dwarf Oregongrape	25%	3.0	0	
BEPI	Piper's Oregongrape	25%	1.0	0	
CEPR	squaw carpet	25%	23.0	.0	
CHME	little prince's-pine	25%	1.0	.0	
CHUM	common prince's-pine	75%	15.7	7.5	
CHVI	green rabbit-brush	25%	5.0	0	
LOCI	trumpet honeysuckle	50%	1.0	0	
PAMY	Oregon boxwood	75%	4.7	4.6	
RICE	squaw currant	25%	7.0	.0	
ROGY	baldhip rose	75%	2.3	.6	
RUNI	snow bramble	25%	3.0	.0	
RUUR	Pacific blackberry	50%	2.5	2.1	
SYMO	creeping snowberry	50%	3.0	1.4	
	TOTAL SHRUB	100%	52.2	13.1	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ADBI	trail-plant, pathfinder	25%	1.0	.0	
ANDE	threeleaf anemone	75%	1.3	.6	
ANLY2	Lyall anemone	25%	1.0	.0	
ARMA3	bigleaf sandwort	50%	1.5	.7	
ASCA3	western wild ginger	25%	4.0	.0	
BORAG		25%	3.0	.0	
CATO	Tolmie's mariposa	25%	1.0	.0	
CASC2	rough harebell	25%	1.0	.0	
CYGR	Pacific hound's-tongue	25%	1.0	.0	
FRVEB	woods strawberry	100%	5.8	6.3	
GAAP	catchweed bedstraw	25%	1.0	.0	
GOOB	rattlesnake-plantain	25%	1.0	.0	
HAL	white-flowered hawkweed	75%	1.0	.0	
HORKE		25%	2.0	.0	
IRIS	iris spp.	25%	1.0	.0	
LIBOL	western twinflower	50%	7.5	3.5	
LUPIN	lupine spp.	25%	8.0	.0	
LUBI	two-colored lupine	25%	5.0	.0	
OSCH	mountain sweet-root	50%	1.0	0	
PERA	leafy lousewort	25%	1.0	0	
POTEN		25%	5.0	.0	
PYPI	whitevein pyrola	25%	1.0	.0	
TRLA2	western starflower	50%	9.0	8.5	
TROV	white trillium	25%	1.0	.0	
VIAD	early blue violet	25%	1.0	.0	
VINU	Nuttall's violet	25%	1.0	.0	
	TOTAL HERB	100%	27.2	17.1	
CAREX	sedge spp.	50%	1.5	.7	
FEOC	western fescue	50%	2.0	1.4	
	TOTAL GRASS	100%	2.5	2.1	

**WHITE FIR - MOUNTAIN HEMLOCK / TWINFLOWER**  
*Abies concolor* - *Tsuga mertensiana* / *Linnaea borealis longiflora*  
**ABCO-TSME/LIBOL**

**EXTENT:** ABCO-TSME/LIBOL occurs on the Ashland, Butte Falls, Prospect, and Diamond Lake Ranger Districts, mostly in the Western Cascades Province, but some sites in the High Cascades Province. N = 5 plots.

**IDENTIFYING CHARACTERISTICS:** The ABCO-TSME/LIBOL Association lacks Shasta red fir and grouse huckleberry, and usually occurs on basaltic soils rather than pumice/ash as do associations of the TSME Series. It supports Pacific yew and bald-hip rose (neither are found in the TSME Series) and a higher herbaceous cover usually associated with more moderate temperatures, such as white inside-out-flower, threeleaf anemone, and Oregon fairy-bell.

**ABIOTIC ENVIRONMENT:** This Association is found above 3700 feet from the middle of the slopes to intermittent stream bottoms. The slopes are gentle and, on the average, are dissected by 2.3 intermittent or larger streams per mile. The aspect is northerly, though it ranges from from northwest to southeast. The parent material is generally basalt and, less commonly, ash and tephra. Soils are deep and about average for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4418.0	517.0
Aspect (deg)	350.6	91.2
Slope (%)	12.2	13.4
Total soil depth (in)	43.8	9.2
Rooting depth (in)	46.3	8.3
Total basal area (ft <sup>2</sup> /ac)	316.0	99.4

**CLIMATE:** Extreme low temperatures are the most limiting factors affecting growth and survival. Late frost is common and soil warms up slowly. Even when air temperatures are warm during the spring, soil temperatures remain cold and may limit moisture uptake. On north aspects, soils can remain frozen well into spring. Although most often the Association occurs on basalts, it may also be found on ash or pumice where frost problems are magnified. Heat conduction is slow and storage is relatively low

in pumice. (Refer to the High Cascade subprovince discussion.)

Moisture stress may be a problem on pyroclastic soils, particularly pumice/ash. Although the unweathered pumice/ash of the C horizon holds water at low tensions, the interlocking of the rough, gravel sized pumice may act as a physical barrier, limiting root growth. However, interparticle moisture availability is often high (Cochran 1971). Fertility is generally low. Organic material greatly increases moisture holding capacity, heat capacity, and conductivity and fertility.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.7	1.4
Maximum month temp (F)	76.9	2.1
Mean annual ppt (in)	54.0	9.6
Dry season ppt (in)	7.4	.9

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	98.2	1.3
Moss (%)	3.2	1.8
Bareground (%)	.4	.5
Gravel (%)	.4	.9
Rock (%)	1.2	1.1
Bedrock (%)	.0	.0

**VEGETATION:** Overstory vegetation is a mixture of white fir, Douglas-fir, and mountain hemlock. Western white pine and, on occasion, Engelmann spruce are also present, particularly in cold air pockets of drainages. White fir dominates the understory, mountain hemlock is always present. Pacific yew is usually present averaging 20 percent cover. Occasional Douglas maple, incense-cedar, golden chinquapin, Engelmann spruce, sugar pine, western white pine, and Douglas-fir are found with lesser amounts of cover.

Of the shrubs, thin-leaved huckleberry is the most evident, followed by dwarf Oregongrape and com-

mon prince's-pine. The latter has very little indicator value, but dwarf Oregongrape and thin-leaved huckleberry indicate deep loamy soils and cool temperatures, respectively. Western twinflower, white inside-out-flower, stream violet, and threelobed anemone are almost always present in the herb layer.

**SILVICULTURE:** This is the most moderate environment that supports significant amounts of mountain hemlock. The variety of tree species provides numerous silvicultural choices. On the negative side, the abundance of mountain hemlock and thin-leaved huckleberry are positively related to the severity of potential silvicultural problems commonly associated with the Mountain Hemlock Series (killer frosts, moisture stress on the pumice/ash, and infertility).

Regardless of the species mix chosen, growth is limited by cold temperature. Compared to other White Fir Associations, productivity is low. White fir and Douglas-fir will do well once spring frost ceases to damage tender buds.

Site preparation on pumice (the Association is only rarely found on pumice) should be a cautious venture. Mechanical methods could displace what little fertile soil exists in the upper layers, leaving the crop trees with few resources.

**WATERSHED MANAGEMENT:** Older stands average about 65 percent herbaceous cover and 70 percent shrub cover. Litter cover and bare ground is rare (less than one percent). If overstory is removed without affecting the shrubs and herbs, the soil and its properties are well protected. However, revegetation is slow and recovery takes several years. Trailing blackberry and Oregon twinflower can be used in disturbed areas. They are native, relatively fast growing, and provide effective ground cover. Thin-leaved huckleberry and Pacific yew, both usually present after harvest, are slow to recover and are of little protective value.

Much of the precipitation falls as snow. Thus, designing activities to capture and store snow may be a consideration if global warming occurs. This Association usually occurs on basaltic soils which are porous and resistant to erosion. Ash sites, although porous, are highly susceptible to erosion.

**FIRE MANAGEMENT:** Evidence of fire was found in 1 of the 5 sample plots. The frequency is well over 100 years. The average stands, over 200 years old, were probably fire generated by intensive fires feeding on long term accumulation of fuels. The pattern seems to be frequent localized occurrences ignited by lightning and infrequent, intense, extensive events during extreme weather periods. Because of the high elevations and occurrence on north aspects, fuels dry slowly.

White fir regeneration provides the fuel ladder in older stands, but Douglas-fir provides the majority of coarse downed fuels. Dried herbaceous species and Douglas-fir needles are the common fine fuels. Production of fuels is relatively slow. There are no specific volatile plants; grasses are present, but rare and low in cover and volume.

**RANGE & WILDLIFE MANAGEMENT:** Of the Associations supporting mountain hemlock, ABCO-TSME/LIBOL produces the most forage. Most is herbaceous, grasses are rare. Huckleberries are abundant in some stands, particularly those with open canopies or with recent local disturbances such as fire or insect/disease pockets. Gooseberries are also present but not common. Trailing blackberry remains at endemic levels until the stand is opened, much like huckleberries, but they respond much faster. Snow limits access until spring, but forage is usually available through summer.

Dense thermal cover is often associated with thickets of white fir regeneration. Generally, shrub cover is too low for either hiding or thermal cover for deer. The high shrub component is often lacking. When it occurs it is usually composed of Douglas maple and golden chinquapin.

**RECREATION & VISUAL MANAGEMENT:** The terrain is gentle; slopes average 12 percent and are usually under 35 percent. Sites are usually not highly dissected and often occur on or below the lower third of the slope. Huckleberry production is negatively related to overstory cover. Douglas maple can provide bright red fall color. Even summer temperatures can be cold, midsummer snows are occasional.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	80%	28.7	11.1	found in drainages warmer sites cold, frost prone sites warmer sites cold sites
PIEN	Engelmann spruce	40%	20.0	7.1	
PILA	sugar pine	20%	2.0	.0	
PIMO	western white pine	60%	9.3	9.3	
PSME	Douglas-fir	60%	35.0	42.0	
TSME	mountain hemlock	60%	20.0	13.2	
	TOTAL OVERSTORY	100%	70.0	10.6	
ABCO	—CONIFERS—				adapted to wet areas susceptible to blister rust frost resistant requires protection from frost occurs in areas with high humidity occurs from the middle of Butte Fall RD north  moist, rocky areas shallow, rocky soils
CADE3	white fir	100%	25.6	20.8	
PIEN	incense-cedar	20%	3.0	.0	
PIEN	Engelmann spruce	20%	8.0	.0	
PILA	sugar pine	20%	2.0	.0	
PIMO	western white pine	40%	2.5	.7	
PSME	Douglas-fir	20%	1.0	.0	
TABR	Pacific yew	60%	33.7	14.8	
TSHE	western hemlock	20%	5.0	.0	
TSME	mountain hemlock	100%	10.0	7.4	
	—HARDWOODS—				
ACGL	Douglas maple	40%	2.5	.7	
CACH	golden chinquapin	60%	1.7	.6	
	TOTAL UNDERSTORY	100%	62.6	14.9	
AMAL	western serviceberry	60%	3.0	1.7	indicates deep, loamy soils      shallow, well-drained soils Ribes are alternate hosts for white pine blister rust            indicates cold environment
BENE	dwarf Oregon grape	80%	9.8	6.7	
CHUM	common prince's-pine	80%	11.2	14.7	
GAOV	slender salal	40%	1.5	.7	
HODI	creambush ocean-spray	20%	2.0	.0	
PAMY	Oregon boxwood	80%	2.5	1.7	
RHMA	Pacific rhododendron	20%	4.0	.0	
RIER	Crater Lake currant	20%	2.0	.0	
RILA	swamp gooseberry	20%	2.0	.0	
RILO	gummy gooseberry	40%	3.0	.0	
RIVI	sticky currant	20%	1.0	.0	
ROGY	baldhip rose	100%	3.0	2.3	
RULA	dwarf bramble	20%	2.0	.0	
RUNI	snow bramble	20%	4.0	.0	
RUPA	thimbleberry	20%	2.0	.0	
RUUR	Pacific blackberry	60%	2.7	2.9	
SOSI	Sitka mountain-ash	20%	1.0	.0	
SYMO	creeping snowberry	40%	1.5	.7	
VAME	thin-leaved huckleberry	100%	26.6	42.2	
WHMO	whipplevine	20%	6.0	.0	
	TOTAL SHRUB	100%	59.4	39.2	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	40%	14.5	3.5	
ADBI	trail-plant, pathfinder	60%	1.7	.6	
ANDE	threeleaf anemone	100%	2.6	1.5	
ANLY2	Lyall anemone	20%	2.0	.0	
ARMA3	bigleaf sandwort	20%	5.0	.0	
CASC2	rough harebell	20%	3.0	.0	
CLUN	queen's cup	80%	6.8	5.7	
COMA3	spotted coral-root	20%	1.0	.0	
COST2	hooded coral-root	20%	1.0	.0	
DELPH		20%	2.0	.0	
DIFO	Pacific bleedingheart	20%	1.0	.0	
DIHOO	Oregon fairybell	60%	2.7	1.2	
FRVEB	woods strawberry	40%	2.0	1.4	
GAAP	catchweed bedstraw	40%	1.0	.0	
GOOB	rattlesnake-plantain	20%	1.0	.0	
HEMI	smallflower alumroot	20%	1.0	.0	
HAL	white-flowered hawkweed	20%	2.0	.0	
LIBOL	western twinflower	100%	19.4	28.7	
MITR2	three-tooth mitrewort	40%	1.5	.7	
MOSI	candyflower	20%	1.0	.0	
OSCH	mountain sweet-root	80%	1.8	.5	
PERA	leafy lousewort	20%	1.0	.0	
PTAQ	bracken	20%	3.0	.0	
PYPI	whitevein pyrola	20%	1.0	.0	
PYSE	one-sided pyrola	40%	1.0	.0	
SMST	starry false Solomon's-seal	60%	2.0	1.7	
SYRE	snow-queen	40%	1.5	.7	
TITR	foamflower	20%	7.0	.0	
TRLA2	western starflower	60%	2.7	1.5	
TROV	white trillium	80%	1.5	1.0	
VAHE	white inside-out-flr	80%	13.2	17.9	
VECA	Calif. false hellebore	20%	2.0	.0	
VIGL	stream violet	100%	1.8	1.3	
VIOR2	round-leaved violet	20%	2.0	.0	
	TOTAL HERB	100%	63.4	31.3	
BRPA	Pacific brome	40%	2.0	1.4	
CAREX	sedge spp.	20%	3.0	.0	
FEOC	western fescue	20%	1.0	.0	
MESU	Alaska oniongrass	20%	1.0	.0	
	TOTAL GRASS	100%	1.8	2.5	

**WHITE FIR - SHASTA RED FIR / COMMON PRINCE'S-PINE**  
*Abies concolor* - *Abies magnifica shastensis* / *Chimaphila umbellatum*  
**ABCO-ABMAS/CHUM**

**EXTENT:** **ABCO-ABMAS/CHUM** occurs in the High Cascade Zone, Rogue River National Forest and Diamond Lake and Tiller Ranger Districts, Umpqua National Forest. N = 19 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of Shasta red fir and the absence of Pacific silver fir in the regeneration layer distinguishes this Association from the others in the White Fir Series. Two similar Associations are **ABMAS/VAME** and **ABCO-ABAM/BENE**. In **ABMAS/VAME**, Shasta red fir dominates the understory with less cover of white fir and is found on colder sites than **ABCO-ABMAS/CHUM**. In **ABCO-ABAM/BENE**, Pacific silver fir is present in the understory and western hemlock is absent.

**ABIOTIC ENVIRONMENT:** **ABCO-ABMAS/CHUM** is located at the highest elevations of the White Fir Series, generally over 4600 feet, though it occurs at 3600 feet on northerly aspects. It is found on all aspects on the middle to upper third of the slope. The slopes are moderate and the intermittent and larger stream frequency is about 1.9 per mile. Parent materials are gradations of andesite or basalt. The total soil depth is average for the Series, but the rooting depth is about 1 inch deeper.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4904.0	566.0
Aspect (deg)	216.1	111.4
Slope (%)	24.3	19.0
Total soil depth (in)	39.7	12.4
Rooting depth (in)	47.1	6.7
Total basal area (ft <sup>2</sup> /ac)	322.1	92.8

**CLIMATE:** **ABCO-ABMAS/CHUM** is found in cold, moderate sites relative to the Series and cool, moderate sites relative to the Cascades Province. The mean annual temperature is one of the lowest of the White Fir Series and the maximum monthly temperature is the lowest. Both the mean annual precipitation and dry season precipitation are average. A large percentage of the precipitation falls as snow with accumulations to 8 feet on some sites. Moisture

is available throughout most of the growing season, as the snowpack feeds the soils. However, stress may develop at the end of the growing season. Cold temperatures will also affect growth rates at both ends of the growing season, limiting biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.5	1.5
Maximum month temp (F)	75.0	2.3
Mean annual ppt (in)	53.4	13.0
Dry season ppt (in)	7.7	1.4

**FOREST FLOOR:** Litter cover is slightly above the Series average of 93 percent and the moss cover is the lowest of the Series. This combination of higher litter cover and comparatively low moss cover is indicative of the cooler environment, where decomposition rates will be slower and growing conditions for moss are less than optimum.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.8	5.9
Moss (%)	2.3	2.1
Bareground (%)	1.0	1.5
Gravel (%)	1.1	1.3
Rock (%)	2.4	2.5
Bedrock (%)	.1	2

**VEGETATION:** White fir, Shasta red fir, and Douglas-fir are abundant in the overstory with western white pine common on the colder sites. The understory is predominantly white fir and Shasta red fir with Douglas-fir, incense-cedar, and golden chinquapin common. Shasta red fir, western white pine, and mountain hemlock indicate cooler sites. Pacific yew is found in the moist sites with high humidity and is associated with late seral stages. The Engelmann spruce is found in cool, moist-wet sites. Douglas-fir, incense-cedar, ponderosa pine, sugar pine, and golden chinquapin indicate warmer, drier sites. Golden chinquapin grows on shallow, rocky sites and Pacific madrone usually

indicates fire has been part of the recent stand history.

White fir, Shasta red fir, and Douglas-fir will invade after a major disturbance. All three are well suited for seeding on mineral soil, however, on frosty sites, Douglas-fir will not survive and grow as well as the others. On the colder sites mountain hemlock will regenerate.

Common prince's-pine, baldhip rose, and thin-leaved huckleberry are common shrub species. Thin-leaved huckleberry indicates cold environments and thrives after disturbance. The herb layer is rich with a variety of common Cascade species including threeleaf anemone, bigleaf sandwort, queen's cup, mountain sweet-root, starry false Solomon's-seal and rough harebell.

**SILVICULTURE:** Douglas-fir, white fir, Shasta red fir, incense-cedar, western white pine, Engelmann spruce, sugar pine, mountain hemlock, and Pacific yew are all appropriate species for regeneration. On the colder, frost prone sites, Shasta red fir and western white pine should be favored with mountain hemlock on the coldest concavities and Engelmann spruce in the cold, moist drainages. On the relatively warmer, drier microsites, Douglas-fir, incense-cedar and sugar pine would be well adapted. For diversity, Pacific yew would do well in areas of low evaporative demand and Pacific madrone and golden chinquapin in warmer, drier, rockier microsites. Advanced regeneration can be utilized in reforestation if injury is minimized during harvest activities. The potential for natural regeneration is estimated to be moderate. **ABCO-ABMAS/CHUM** has a higher average basal area than the Series.

Total shrub cover ranges from 2 to 102 percent with an average of 40.8 percent, below average for the White Fir Series. Most often the cover is thin-leaved huckleberry and common prince's-pine. Vegetation competition from these species usually does not diminish timber volume production. Vine maple and Pacific rhododendron are potential vegetation management problems where they occur. Herb cover ranges from 3 to 116 percent with an average of 51.3 percent, slightly higher than the Series average, but not a serious competitor.

**WATERSHED MANAGEMENT:** Total annual precipitation ranges from 35 inches at Butte Falls to 75 inches at Tiller with an average of 53.4 inches. The

majority falls as snow with only 6 to 10 inches falling during the dry season (May through September).

Most of the sample plots were on andesites and basalts at high elevations with slopes ranging from 10 to 35 percent. These soils are usually well drained with moderate infiltration rates and the soil erosion potential is slight. The soils are usually very stable with low risk of mass movement. Compaction as a result of management activities can lessen survival and growth. (These are generalities from the Umpqua National Forest and Rogue River National Forest Soil Resource Inventories. Refer to them for site specifics.)

The vegetation cover is below average for shrubs and average for herbs, and revegetation following management activities will be moderately slow in the cool, mesic environment. **ABCO-ABMAS/CHUM** is found on the middle to upper third of the ridges and is not located near riparian areas.

**FIRE MANAGEMENT:** **ABCO-ABMAS/CHUM** is found at high elevations on cool, mesic sites with low evaporative demand. Snowbanks are present into the early summer and thunderstorms bring occasional summer rain. This combination keeps the fuels from drying out until late in the season. Fuels accumulate slowly and the decomposition rate is slowed by the cool temperatures. Evidence of fire was noted on only 4 of the 19 plots with a frequency of 100 to 250 or more years between intense, stand regenerating fires.

**RANGE & WILDLIFE MANAGEMENT:** Forage for wildlife or domestic range use is limited. Little browse and only moderate herbage is available. Although browse species such as Pacific blackberry, dwarf bramble, thimbleberry, California hazel and creambush ocean-spray occur, cover is usually low. Grass cover is average for the White Fir Series (2.1 percent). Water is moderately available, with 1.9 intermittent or larger streams per mile.

Both forest floor and vertical structure are diverse. Stands generally provide thermal cover, with patches of hiding cover of shrubs and regeneration. Snags and down, woody material are variable, some stands having concentrations and some having little.

**RECREATION & VISUAL MANAGEMENT:** **ABCO-ABMAS/CHUM** is typical of the higher elevation

Cascade landscape. The climate is cool and the potential for interesting views is high when the Association is found on the upper third of the slope. Occasional vine maple, Douglas maple and Pacific

rhododendron add color in the spring and fall. Thin-leaved huckleberry and trailing blackberry may provide a good crop of berries in the late summer or early fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	78%	31.2	19.3	indicates cold, moderate conditions  found in cool, moist-wet sites established under warmer conditions  evidence of past fire history  found on the cold, wet sites
ABMAS	Shasta red fir	84%	20.6	15.7	
CADE3	incense-cedar	21%	12.7	9.3	
PIEN	Engelmann spruce	5%	2.0	.0	
PILA	sugar pine	15%	5.7	1.5	
PIMO	western white pine	42%	7.8	6.0	
PIPO	ponderosa pine	5%	6.0	.0	
PSME	Douglas-fir	78%	24.3	21.7	
TSME	mountain hemlock	5%	5.0	0	
	TOTAL OVERSTORY	100%	68.7	12.7	
	—CONIFERS—				
ABCO	white fir	100%	25.7	12.3	good in areas with poor drainage  cold or frost prone areas warmer sites moist sites with high humidity suitable for the coldest sites
ABMAS	Shasta red fir	100%	13.7	10.1	
CADE3	incense-cedar	42%	6.6	4.2	
PIEN	Engelmann spruce	5%	3.0	.0	
PILA	sugar pine	5%	1.0	.0	
PIMO	western white pine	21%	7.5	5.0	
PSME	Douglas-fir	47%	10.2	11.6	
TABR	Pacific yew	21%	24.2	22.6	
TSHE	western hemlock	5%	6.0	.0	
TSME	mountain hemlock	31%	4.7	5.2	
	—HARDWOODS—				
ACCI	vine maple	5%	60.0	0	indicates fire history shallow, rocky soils
ACGL	Douglas maple	10%	12.5	3.5	
ARME	Pacific madrone	5%	2.0	0	
CACH	golden chinquapin	47%	9.4	12.1	
	TOTAL UNDERSTORY	100%	64.8	27.0	
AMAL	western serviceberry	21%	4.3	3.0	deep, fertile soils dry, rockier, less productive sites than BENE
BENE	dwarf Oregongrape	57%	9.1	9.7	
BEPI	Piper's Oregongrape	5%	10.0	.0	
CHME	little prince's-pine	21%	1.5	1.0	generally found on hot, dry sites  shallow, well drained soil
CHUM	common prince's-pine	84%	7.8	12.1	
COCOC	California hazel	42%	7.8	6.3	
GAFR	Fremont silk-tassel	5%	2.0	0	
GAOV	slender salal	10%	1.5	.7	
HODI	creambush ocean-spray	5%	3.0	.0	
PAMY	Oregon boxwood	52%	3.8	4.4	
RHMA	Pacific rhododendron	5%	2.0	.0	
RIBES	currant spp.	52%	3.2	1.8	
RILA	swamp gooseberry	10%	2.0	1.4	
RILO	gummy gooseberry	5%	5.0	.0	cool to cold, moist sites cool, moist forests  cool sites, well drained soils cold, high elevation sites
RIVI	sticky currant	21%	3.5	4.4	
ROGY	baldhip rose	73%	3.5	1.8	
RULA	dwarf bramble	42%	4.6	8.3	
RUNI	snow bramble	5%	7.0	.0	
RUPA	thimbleberry	10%	1.0	0	
RUUR	Pacific blackberry	47%	3.2	2.3	
SOSI	Sitka mountain-ash	10%	1.5	7	
SYAL	common snowberry	5%	1.0	0	
SYMO	creeping snowberry	47%	2.7	1.7	
VAME	thin-leaved huckleberry	63%	17.2	25.6	
VASC	grouse huckleberry	5%	1.0	.0	
WHMO	whipplevine	5%	1.0	.0	
	TOTAL SHRUB	100%	40.8	31.1	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	42%	15.9	17.6	
ADBI	trail-plant, pathfinder	63%	3.1	3.9	
ANMA	common pearly-everlasting	5%	2.0	.0	
ANDE	threeleaf anemone	94%	2.5	1.5	
ANLY2	Lyal anemone	10%	3.5	.7	
ARMA3	bigleaf sandwort	89%	2.8	3.4	
ASCA3	western wild ginger	36%	4.0	4.9	
ASHA	marbled wild ginger	10%	2.0	1.4	
CABU2	fairy-slipper	5%	1.0	.0	
CAPR3	California harebell	5%	1.0	.0	
CASC2	rough harebell	73%	1.9	1.3	
CARDA		5%	1.0	.0	
CAPUP	purple reedgrass	5%	1.0	.0	
CLUN	queen's cup	78%	2.5	1.7	
COMA3	spotted coral-root	26%	1.0	.0	
COME	Pacific coral-root	15%	1.0	.0	
COST2	hooded coral-root	26%	1.0	.0	
CYGR	Pacific hound's-tongue	10%	1.0	.0	
DELPH		10%	1.5	.7	
DIFO	Pacific bleedingheart	26%	1.2	.4	
DIHOO	Oregon fairybell	42%	1.3	.5	
ERAL	Alice fleabane	5%	3.0	.0	
FRVEB	woods strawberry	57%	1.7	.9	
GAAP	catchweed bedstraw	52%	1.2	.4	
GAOR	Oregon bedstraw	21%	2.0	1.4	
GOOB	rattlesnake-plantain	63%	1.1	.3	
HEMI	smallflower alumroot	10%	1.0	.0	
HIAL	white-flowered hawkweed	68%	1.7	1.3	
IRIS	iris spp.	5%	1.0	.0	
LAPO	leafy peavine	21%	3.0	1.2	
LIBOL	western twinflower	52%	16.7	12.4	
LICA3	northwest listera	15%	1.0	.0	
LUPIN	lupine spp.	5%	8.0	.0	
MECI	ciliate bluebells	5%	5.0	.0	
MITEL		5%	1.0	.0	
MITR2	three-tooth mitrewort	31%	1.3	.8	
MOSI	candyflower	36%	2.0	1.4	
NEHE	small white nemophila	10%	1.0	.0	
OSCH	mountain sweet-root	78%	1.4	.7	
PERA	leafy lousewort	21%	2.0	2.0	
PHACE		10%	1.0	.0	
PHHA	whiteleaf phacelia	5%	1.0	.0	
POMU	western sword-fern	10%	1.5	.7	
PTAQ	bracken	36%	3.7	3.1	
PYPI	whitevein pyrola	36%	1.1	.4	
PYSE	one-sided pyrola	57%	1.1	.3	
SMRA	western false Solomon's-seal	15%	1.3	.6	
SMST	starry false Solomon's-seal	84%	2.2	1.7	
SYRE	snow-queen	21%	2.5	1.9	
TRLA2	western starflower	63%	2.1	1.2	
TROV	white trillium	52%	1.6	1.3	
VASI	mountain heliotrope	5%	5.0	.0	
VAHE	white inside-out-flr	68%	4.5	5.3	
VECA	Calif. false hellebore	15%	1.0	.0	
VIAM	American vetch	5%	1.0	.0	
VIGL	stream violet	42%	5.0	10.1	
VIOR2	round-leaved violet	5%	1.0	.0	
XETE	common beargrass	5%	5.0	.0	

	TOTAL HERB	100%	51.3	30.9	
BROMU	brome spp.	5%	1.0	.0	
BRER	meadow brome	5%	3.0	.0	
BRPA	Pacific brome	21%	2.3	1.0	
BRVU	Columbia brome	5%	1.0	.0	
CAREX	sedge spp.	21%	3.5	4.4	
ELGL	blue wildrye	5%	2.0	.0	
FEOC	western fescue	10%	1.5	.7	
MEHA	Harford's melic	5%	1.0	.0	
MESU	Alaska oniongrass	10%	1.5	.7	
	TOTAL GRASS	100%	2.1	2.7	

**WHITE FIR - PACIFIC SILVER FIR / DWARF OREGONGRAPE**  
*Abies concolor* - *Abies amabilis* / *Berberis nervosa*  
**ABCO-ABAM/BENE**

**EXTENT:** ABCO-ABAM/BENE occurs on the Diamond Lake, North Umpqua and Tiller Ranger Districts, Umpqua National Forest. N = 9 plots.

**IDENTIFYING CHARACTERISTICS:** Only two of the White Fir Associations have Pacific silver fir in the understory, ABCO-ABAM/BENE and ABCO-TSHE/ACCI. ABCO-TSHE/ACCI has western hemlock in the understory and ABCO-ABAM/BENE does not. The high cover of white fir in the understory differentiates ABCO-ABAM/BENE from the Pacific Silver Fir Series.

**ABIOTIC ENVIRONMENT:** ABCO-ABAM/BENE is found at the highest elevations of the Series, usually above 4400 feet on the middle to upper third of long slopes (averaging 2600 feet). Slopes are average for the Series and local relief is flat or convex. The topography is dissected with an average of 4.5 intermittent or larger streams per mile. Basalt and andesite are the most common parent rock followed by ash and tephra. Total soil depth is 3 inches deeper than average for the Series and the rooting depth is 15 inches deeper. ABCO-ABAM/BENE has the greatest average basal area per acre for the White Fir Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4861.0	270.0
Aspect (deg)	103.9	65.8
Slope (%)	31.2	19.0
Total soil depth (in)	44.1	9.4
Rooting depth (in)	47.6	4.7
Total basal area (ft <sup>2</sup> /ac)	348.9	81.3

**CLIMATE:** ABCO-ABAM/BENE is found in the coldest, wettest sites of the White Fir Series and cooler, wetter sites of the Cascades Province as well. The average annual temperature and maximum monthly temperature are the lowest for the Series, while mean annual precipitation and dry season precipitation are the highest. Snowfall accumulations average 4 to 5 feet. Low soil and air temperatures are the most limiting factor affecting biomass production. Frost events into July are probably common. Moisture is available throughout

most of the growing season, in part due to the winter snowpack and in part due to summer thunderstorms. Moisture stress develops late in the growing season, if at all.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.5	.7
Maximum month temp (F)	75.1	1.1
Mean annual ppt (in)	68.3	6.1
Dry season ppt (in)	9.3	1.2

**FOREST FLOOR:** Litter cover is above the Series average of 93 percent and the cover of moss, bareground, gravel, rock and bedrock are all well below average. This combination of higher litter cover and comparatively low moss cover is indicative of the cooler, wetter environment that limits decomposition and incorporation of organic matter.

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.8	1.9
Moss (%)	3.1	2.6
Bareground (%)	.9	1.1
Gravel (%)	.8	.8
Rock (%)	2.8	3.1
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir and white fir dominate the overstory. White fir dominates the understory with Pacific silver fir slightly less abundant. Mountain hemlock, Pacific silver fir, and western white pine are common on the colder sites, with mountain hemlock found on the slightly drier sites and Pacific silver fir on the wetter sites. Pacific yew is found in the moist sites with high humidity and is associated with late seral stages. Engelmann spruce is found in the cool, wet concavities; Shasta red fir, incense-cedar and Douglas-fir on the warmer, drier sites; and golden chinquapin on the shallow, rockier sites.

White fir, Douglas-fir, and Shasta red fir will invade after a major disturbance. All three are well suited for seeding on mineral soil, however, on frosty sites, Douglas-fir is susceptible to frost damage and



grows poorly. On colder sites, mountain hemlock and western white pine will survive and grow well. Under a canopy, white fir, Pacific silver fir, and mountain hemlock typically establish themselves and are well suited for uneven age management.

Abundant shrubs include dwarf Oregongrape and common prince's-pine. Common shrubs include baldhip rose, creeping snowberry, and thin-leaved huckleberry. Thin-leaved huckleberry indicates cold environments and thrives after disturbance. Common herbs include vanillaleaf, trail-plant, queen's cup, starry false Solomon's-seal, foamflower, and white inside-out-flower - all typical Cascades Province herbs.

**SILVICULTURE:** White fir, Pacific silver fir, Douglas-fir, mountain hemlock, incense-cedar, Shasta red fir, Engelmann spruce, and western white pine are appropriate for regeneration. Mountain hemlock, Shasta red fir, and western white pine would be best suited to the coldest sites; Douglas-fir and incense-cedar to the warmer sites; and Engelmann spruce in the wet areas. For diversity, Pacific yew would do well in areas of low evaporative demand and golden chinquapin on the rockier sites. Douglas-fir, white fir, and Shasta red fir would be the most productive on the average site. The total basal area for ABCO-ABAM/BENE is the highest of the White Fir Series with the timber volume and biomass production moderate.

Total shrub cover ranges from 5 to 112 percent with an average of 39.6 percent, below average for the Series. Most of the cover is dwarf Oregongrape and thin-leaved huckleberry. Thin-leaved huckleberry can physically interfere with reforestation activities and compete with crop trees for resources, but is not a threat to timber volume production. Pacific rhododendron can interfere both physically and competitively. Herb cover is average for the Series, ranging from 11 to 95 percent with an average of 45 percent, and provides some competition with conifers for resources.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 60 inches on the North Umpqua Ranger District to 80 inches near Diamond Lake with an average of 68.3 inches. The majority falls as snow during the winter with some rain in the fall and spring. Eight to 11 inches falls as rain during the dry season (May through September). ABCO-ABAM/BENE has the highest annual precipitation

for the White Fir Series and the lowest annual temperature. Snow retention can be designed into management activities by varying the shape and topographic position of harvest units.

The majority of sample plots were found on andesite or basalt above 4500 feet elevation and on gentle slopes (10 to 35 percent). These soils generally have moderate infiltration rates and low to moderate runoff potential. The soils are rated as very stable and there is no expected mass movement as a result of management activities; however, compaction may be a problem. The potential for soil erosion is slight. (These are generalities from the Umpqua National Forest Soil Resource Inventory. Refer to it for site specifics.)

Shrub and herb cover is slightly less than average for the Series and revegetation following disturbance is slow in the cool environment. This Association may be found near riparian or wet areas, as indicated by Engelmann spruce on one of the plots, but the majority of the time it is commonly found on the upper or middle third of flat or convex slopes.

**FIRE MANAGEMENT:** Evidence of fire was found on 2 of the 9 sample plots with a frequency of 200 to 500 years between intense, stand regenerating fires. The stands are found at the middle to upper third of high elevation ridges with the coldest average temperatures and the highest annual precipitation, so fuels are slow to dry. Pacific silver fir produces above average ground fuels but in the cold environment the decomposition rate is slow. Pacific silver fir and white fir regeneration provide a fuel ladder to the overstory.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited by the lack of palatable shrubs and low herbage. Browse species such as Pacific blackberry, California hazel, cream-bush ocean-spray, dwarf bramble and thimbleberry are sparsely scattered throughout the stands. Grass cover is sparse (1.7 percent) which is about average for the Series. Intermittent or larger streams usually occur within a quarter mile.

Both forest floor and stand structure are diverse. Stands generally provide thermal cover, with occasional patches of hiding cover of shrubs or regeneration. Snags and down, woody material vary, some stands having heavy concentrations and some having little.

**RECREATION & VISUAL MANAGEMENT:** **ABCO-ABAM/BENE** is found at the highest elevations of the White Fir Series and has more of the recreational aspects of higher elevations, such as skiing in the winter and berry picking opportunities with thin-

leaved huckleberry. Locations at the upper third of the ridges provide the potential for scenic views. Occasional vine maple, Douglas maple and Pacific rhododendron provide color during the fall and the spring.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	33%	2.7	.6	indicates cold, wet sites
ABCO	white fir	77%	28.6	11.8	
ABMAS	Shasta red fir	44%	12.2	2.6	cold, relatively drier sites
CADE3	incense-cedar	33%	7.3	6.8	
PIEN	Engelmann spruce	11%	2.0	.0	wet sites and drainages
PIMO	western white pine	22%	4.0	1.4	cold or frost prone sites
PSME	Douglas-fir	100%	30.2	18.6	warmer, drier sites
TSME	mountain hemlock	33%	4.7	3.5	cold, moderate sites
	TOTAL OVERSTORY	100%	63.9	10.1	
ABAM	---CONIFERS---				
ABAM	Pacific silver fir	100%	12.4	14.1	
ABCO	white fir	100%	23.4	13.1	
ABMAS	Shasta red fir	22%	1.5	.7	cold, moderate
CADE3	incense-cedar	33%	5.7	4.0	
PIEN	Engelmann spruce	11%	1.0	.0	suitable for wetter areas
PIMO	western white pine	22%	2.0	0	will survive and grow on cold sites
PSME	Douglas-fir	22%	9.0	8.5	requires protection in frost prone areas
TABR	Pacific yew	22%	9.0	1.4	associated with late seral stages
TSME	mountain hemlock	55%	12.2	13.1	will survive and grow on cold sites
	---HARDWOODS---				
ACCI	vine maple	11%	9.0	.0	
ACGL	Douglas maple	22%	6.5	4.9	
CACH	golden chinquapin	55%	3.2	2.2	not tolerant of cold air pockets
	TOTAL UNDERSTORY	100%	53.7	20.3	
AMAL	western serviceberry	11%	1.0	.0	
BENE	dwarf Oregongrape	77%	8.3	5.5	deep, loamy soils
CHME	little prince's-pine	22%	1.0	.0	
CHUM	common prince's-pine	77%	4.6	4.5	
COCOC	California hazel	22%	5.5	6.4	
GASH	salal	11%	1.0	0	warm, dry well-drained soils
HODI	creambush ocean-spray	11%	1.0	0	
PAMY	Oregon boxwood	44%	2.0	8	
RHMA	Pacific rhododendron	22%	50.5	70.0	shallow, well-drained soils
RIBI	Siskiyou gooseberry	11%	2.0	.0	
RICE	squaw currant	11%	3.0	.0	moderate to high elevations
RILA	swamp gooseberry	33%	3.7	3.1	
RIVI	sticky currant	11%	3.0	.0	higher elevations, drier sites
ROGY	baldhip rose	66%	2.8	1.0	
RULA	dwarf bramble	33%	2.0	1.7	cool areas, mid to upper elevations
RUNI	snow bramble	11%	1.0	.0	cool, moist forests
RUPA	thimbleberry	22%	1.0	.0	
RUUR	Pacific blackberry	44%	8.5	11.1	
SYMO	creeping snowberry	66%	1.8	1.2	
VAME	thin-leaved huckleberry	66%	6.8	9.0	cool, well-drained sites
WHMO	whipplevine	22%	5.0	1.4	
	TOTAL SHRUB	100%	39.6	33.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	88%	7.1	5.7	
ACRU	baneberry	11%	1.0	.0	
ADBI	trail-plant, pathfinder	77%	1.6	.5	
ANMA	common pearly- everlasting	11%	3.0	.0	
ANDE	threeleaf anemone	66%	1.8	.8	
ANLY2	Lyall anemone	11%	1.0	.0	
APAN	spreading dogbane	11%	1.0	.0	
AQFO	Sitka columbine	11%	1.0	.0	
ARMA3	bigleaf sandwort	55%	1.4	.5	
ASCA3	western wild ginger	33%	6.0	7.8	
ASHA	marbled wild ginger	11%	1.0	.0	
ASTR	maidenhair spleenwort	11%	2.0	.0	
ASTER		11%	2.0	.0	
CASC2	rough harebell	33%	1.3	.6	
CIRSI		11%	1.0	.0	
CLUN	queen's cup	88%	3.0	1.4	
COHE	varied-leaved collomia	11%	1.0	.0	
CORAL	coral-root	11%	1.0	.0	
DETR	Columbia River larkspur	11%	1.0	.0	
DIHOO	Oregon fairybell	66%	1.7	1.2	
EPAN	fireweed	11%	1.0	.0	
FRVEB	woods strawberry	22%	3.5	2.1	
GAAP	catchweed bedstraw	66%	1.3	.8	
GAOR	Oregon bedstraw	22%	2.0	.0	
GATR	fragrant bedstraw	11%	2.0	0	
GOOB	rattlesnake-plantain	66%	1.0	0	
HIAL	white-flowered hawkweed	66%	1.2	.4	
LAPO	leafy peavine	22%	2.0	1.4	
LICO4	tiger lily	11%	1.0	0	
LIBOL	western twinflower	66%	4.7	4.4	
LICA3	northwest listera	11%	1.0	0	
LUAL	sickle-keeled lupine	11%	2.0	0	
MECA2	Idaho bluebells	11%	1.0	.0	
MITR2	three-tooth mitrewort	11%	1.0	.0	
MOSI	candyflower	22%	8.0	9.9	
ORPU	dwarf owl-clover	11%	1.0	.0	
OSCH	mountain sweet-root	55%	1.0	.0	
PERA	leafy lousewort	11%	1.0	.0	
PHHA	whiteleaf phacelia	11%	1.0	.0	
PHNE	woodland phacelia	11%	1.0	.0	
PHAD	woodland phlox	11%	3.0	0	
POMU	western sword-fern	22%	1.0	0	
PTAQ	bracken	44%	9.3	13.9	
PYAP	leafless pyrola	11%	1.0	.0	
PYPI	whitevein pyrola	44%	1.0	.0	
PYSE	one-sided pyrola	55%	1.0	0	
RUDBE		11%	2.0	0	
SMRA	western false Solomon's- seal	11%	1.0	0	
SMST	starry false Solomon's-seal	88%	3.9	4.7	
SYRE	snow-queen	22%	1.0	0	
TITR	foamflower	77%	1.6	.5	
TRLA2	western starflower	55%	1.4	.5	
TROV	white trillium	66%	1.2	.4	
VASI	mountain heliotrope	11%	1.0	0	
VAHE	white inside-out-flr	88%	2.8	1.6	
VECA	Calif. false hellebore	11%	1.0	.0	
VIAM	American vetch	22%	1.0	0	
VIGL	stream violet	66%	1.2	.4	

VIOR2	round-leaved violet	33%	1.0	.0	
XETE	common beargrass	11%	3.0	0	
	TOTAL HERB	100%	45.2	25.9	
BRVU	Columbia brome	11%	4.0	.0	
CARO	Ross sedge	11%	1.0	.0	
ELGL	blue wildrye	11%	1.0	.0	
FEOC	western fescue	33%	1.0	.0	
MESU	Alaska oniongrass	22%	1.5	.7	
	TOTAL GRASS	100%	1.7	2.4	

**WHITE FIR - WESTERN HEMLOCK / VINE MAPLE**  
*Abies concolor* - *Tsuga heterophylla* / *Acer circinatum*  
**ABCO-TSHE/ACCI**

**EXTENT:** ABCO-TSHE/ACCI is found on the Diamond Lake and Tiller Ranger Districts, Umpqua National Forest. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** The combination of western hemlock and Pacific silver fir in the understory differentiates ABCO-TSHE/ACCI from the other Associations in the White Fir Series and from TSHE-ABCO/RHMA.

**ABIOTIC ENVIRONMENT:** ABCO-TSHE/ACCI is located at the upper elevations of the Series, ranging from 3500 feet to 4700 feet. It is found from the upper third of the slope to the lower third on eastern to southern aspects. Slopes are the steepest and the most highly dissected of the Series with 4.8 intermittent or larger streams per mile. Parent material is mainly tephra, but may occasionally be andesite. Soils are deep, with total soil depth 2 inches deeper than the Series average and rooting depth 4 inches deeper.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4090.0	498.0
Aspect (deg)	165.7	47.0
Slope (%)	58.2	10.9
Total soil depth (in)	42.90	14.2
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	320.0	226.3

**CLIMATE:** Temperatures are average, both maximum monthly and mean annual, for the Series; but the mean annual precipitation and dry season precipitation is the highest for the Series. Relative to the Cascade Province, ABCO-TSHE/ACCI is of moderate temperature; but again, much greater than average precipitation. Moisture is readily available throughout most of the growing season, becoming limiting simultaneously with temperature in late summer and fall.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	44.8	1.3
Maximum month temp (F)	78.2	2.0
Mean annual ppt (in)	67.5	5.0
Dry season ppt (in)	10.0	.0

**FOREST FLOOR:** Litter cover is above the Series average and moss cover is below average. This combination of higher litter cover and comparatively low moss cover is indicative of a cooler environment, where decomposition rates are slower and growing conditions for moss are less than optimum.

FOREST FLOOR	MEAN	S.D.
Litter (%)	97.0	2.4
Moss (%)	6.3	3.5
Bareground (%)	1.0	1.4
Gravel (%)	.5	6
Rock (%)	1.3	1.3
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir usually dominates the overstory; white fir is abundant. The understory is dominated by white fir, however, Pacific silver fir, western hemlock, and vine maple are always present. Western white pine indicates the coldest sites with incense-cedar, Douglas-fir, golden chinquapin, and sugar pine found in the warmer, relatively drier sites. Pacific yew is found in the moist sites with high humidity and is associated with late seral stages.

Douglas-fir and white fir will regenerate following disturbance. Both seed well on mineral soil, however, on frosty sites Douglas-fir is susceptible and grows poorly. Western hemlock, white fir, and Pacific silver fir typically establish themselves under a dense canopy and are well suited for uneven age management.

Dwarf Oregongrape, common prince's-pine, bald-hip rose, and Pacific blackberry are found in most areas and are common Cascade shrubs. The cool, moist sites are indicated by the slender salal, Ore-

gon boxwood, snow bramble, and thin-leaved huckleberry. The herb layer contains the usual complement of Cascade species including vanilla leaf, pathfinder, rough harebell, queen's cup, Oregon fairybell, rattlesnake-plantain, white-flowered hawkweed, western twinflower, mountain sweet-root, whitevein pyrola, foamflower, white trillium, white inside-out-flower, stream violet, and round-leaved violet.

**SILVICULTURE:** White fir, Douglas-fir, western hemlock, Pacific silver fir, incense-cedar, sugar pine, and western white pine are all appropriate species for regeneration. Pacific silver fir and western white pine would be best suited to the colder sites with sugar pine and Douglas-fir to the warmer sites. For additional diversity, Pacific yew grows well in areas of low evaporative demand and golden chinquapin survives rockier sites. White fir and Douglas-fir are the most productive on the average site. Total basal area for ABCO-TSHE/ACCI is above average for the White Fir Series. Timber volume and biomass production are moderate.

Total shrub cover ranges from 10 to 89 percent with an average of 33.5 percent, below average for the Series. Most of the shrub cover is dwarf Oregon grape and common prince's-pine, neither of which is a major competitor with crop trees. In some stands, the cover of Pacific rhododendron is high, providing both a physical barrier to reforestation and competition. Herb cover is slightly above average for the Series, ranging from 14 to 76 percent, with an average of 52 percent, and provides some competition.

**WATERSHED MANAGEMENT:** Total mean precipitation ranges from 60 to 70 inches with an average of 67.5 inches. This is one of the highest precipitation rates in the White Fir Series. Most falls as rain from the fall through the spring with 10 inches falling during the dry season (May through September). The majority of the sample plots are on pumice soils that are excessively well to well drained with moderate to high infiltration rates and low runoff rates. The surface erosion potential and mass wasting potential is low; with low risk of compaction from management activities. (See the Umpqua National Forest

Soil Resource Inventory for site specific information.)

Total shrub cover is below average for the Series, but the herb cover is slightly higher than average. Revegetation following disturbance will be moderate. ABCO-TSHE/ACCI will generally not be found near riparian areas, though it may be found on the lower third of the slope or in slight concavities.

**FIRE MANAGEMENT:** No evidence of fire was noted on any of the sample plots. Frequency of fires is 200 to 250 or more years between intense, stand regenerating fires. Found at the higher elevations with high average annual precipitation, the fuels dry slowly. Pacific silver fir, white fir, and western hemlock regeneration provide a fuel ladder to the overstory.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited by the lack of palatable browse and only moderate herb cover on most sites. Browse species such as red huckleberry, trailing blackberry, California hazel, Pacific dogwood, creambush oceanspray, dwarf bramble, and snow bramble are sparsely scattered throughout the stands. Grass cover is 0.5 percent, the lowest of the Series. Intermittent or larger streams usually occur within a quarter mile. Stands generally provide thermal cover with patches of hiding cover of shrubs and regeneration.

Both forest floor and stand structure are diverse. Snags and down, woody material vary, some stands having heavy concentrations and some having little.

**RECREATION & VISUAL MANAGEMENT:** The terrain is steep and dissected, with sites occurring on the upper to lower third of the slope, and are generally not conducive to developed recreation. Scenic vistas are infrequent, but the stands themselves are diverse in structure. Trailing blackberry, thin-leaved huckleberry, and red huckleberry are scattered throughout. Pacific rhododendron, Pacific dogwood, and vine maple provide color in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABAM	Pacific silver fir	25%	6.0	.0	cold, wet sites
ABCO	white fir	75%	14.3	9.8	
ABMAS	Shasta red fir	25%	5.0	0	cold, moderate sites
CADE3	incense-cedar	25%	2.0	.0	
PILA	sugar pine	25%	15.0	.0	susceptible to blister rust
PIMO	western white pine	25%	15.0	.0	cold, frost prone sites
PSME	Douglas-fir	100%	47.5	27.2	warmer, relatively drier sites
TSHE	western hemlock	25%	10.0	.0	co-climax species
	TOTAL OVERSTORY	100%	71.5	13.9	
ABAM	---CONIFERS---				
ABAM	Pacific silver fir	100%	8.8	7.9	cold, wet sites
ABCO	white fir	100%	29.7	8.6	co-climax
CADE3	incense-cedar	75%	11.3	16.2	
PILA	sugar pine	25%	3.0	.0	intermediate in light tolerance
PIMO	western white pine	50%	1.0	.0	frost tolerant
PSME	Douglas-fir	50%	9.5	7.8	
TABR	Pacific yew	25%	2.0	.0	moist sites with high humidity
TSHE	western hemlock	100%	10.5	7.4	co-climax
	---HARDWOODS---				
ACCI	vine maple	100%	20.0	4.1	
CACH	golden chinquapin	25%	20.0	.0	rocky, well-drained soil
	TOTAL UNDERSTORY	100%	89.0	25.7	
BENE	dwarf Oregongrape	100%	4.5	4.0	deep, fertile soils
CHME	little prince's-pine	25%	2.0	.0	indicates low light levels
CHUM	common prince's-pine	100%	3.5	1.7	mid to late successional
CONU	Pacific dogwood	25%	2.0	.0	
COCOC	California hazel	25%	2.0	.0	
GAOV	slender salal	25%	3.0	.0	
HODI	creambush ocean-spray	25%	2.0	.0	
PAMY	Oregon boxwood	25%	1.0	.0	moist conditions and cool sites
RHMA	Pacific rhododendron	25%	60.0	0	competes with seedlings
ROGY	baldhip rose	75%	1.7	6	
RULA	dwarf bramble	50%	1.5	7	cool to cold, moist sites
RUNI	snow bramble	50%	1.5	.7	
RUUR	Pacific blackberry	75%	1.7	.6	
SOSI	Sitka mountain-ash	25%	1.0	.0	
SYMO	creeping snowberry	50%	1.0	.0	
VAME	thin-leaved huckleberry	50%	2.5	.7	cool sites, well-drained
VAPA	red huckleberry	25%	3.0	.0	not on cold, frosty sites
WHMO	whipplevine	50%	2.5	.7	
	TOTAL SHRUB	100%	33.5	37.3	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	75%	18.7	22.8	moist sites, well-drained soils
ADBI	trail-plant, pathfinder	75%	3.0	2.6	
ALVI	candystick	25%	1.0	.0	
ANDE	threeleaf anemone	50%	1.5	.7	cooler, more moist sites than ARCO
ARMA3	bigleaf sandwort	25%	3.0	.0	
ARLA	mountain arnica	25%	3.0	.0	
ASCA3	western wild ginger	50%	2.5	2.1	late successional
CASC2	rough harebell	75%	2.3	1.2	
CLUN	queen's cup	100%	2.3	1.0	
COST2	hooded coral-root	25%	1.0	.0	mid to late successional
DIHOO	Oregon fairybell	100%	3.5	3.3	
FRVEB	woods strawberry	25%	1.0	.0	
GAAP	catchweed bedstraw	50%	1.0	0	fixes nitrogen
GAOR	Oregon bedstraw	25%	1.0	.0	
GOOB	rattlesnake-plantain	75%	1.0	.0	
HIAL	white-flowered hawkweed	75%	2.3	.6	generally productive sites may invade after a disturbance
LAPO	leafy peavine	25%	1.0	.0	
LIBOL	western twinflower	100%	4.0	.8	
LICA3	northwest listera	25%	1.0	.0	mesic sites
MOSI	candyflower	25%	2.0	.0	
OSCH	mountain sweet-root	75%	2.0	1.0	
PERA	leafy lousewort	25%	1.0	0	
POMU	western sword-fern	25%	1.0	.0	
PTAQ	bracken	25%	1.0	.0	
PTAN	woodland pinedrops	25%	1.0	.0	
PYAP	leafless pyrola	25%	1.0	.0	
PYPI	whitevein pyrola	100%	1.3	.5	
PYSE	one-sided pyrola	50%	1.0	.0	
SMRA	western false Solomon's-seal	25%	1.0	.0	
SMST	starry false Solomon's-seal	50%	3.5	2.1	
TITR	foamflower	75%	6.0	5.3	
TRLA2	western starflower	25%	1.0	.0	
TROV	white trillium	75%	1.0	0	
VAHE	white inside-out-flr	75%	1.3	.6	
VECA	Calif. false hellebore	25%	1.0	.0	
VIGL	stream violet	75%	1.7	.6	
VIOR2	round-leaved violet	100%	2.0	.8	
	TOTAL HERB	100%	52.0	27.6	
BROMU	brome spp.	25%	1.0	.0	
MESU	Alaska oniongrass	25%	1.0	.0	
	TOTAL GRASS	100%	5	.6	

**WHITE FIR / SNOW BRAMBLE / VANILLALEAF**  
*Abies concolor* / *Rubus nivalis* / *Achlys triphylla*  
**ABCO/RUNI/ACTR**

**EXTENT:** ABCO/RUNI/ACTR is found on the Diamond Lake, Prospect, and Tiller Ranger Districts, in the Western Cascade Province near the contact with High Cascades. N = 7 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/RUNI/ACTR is typical of the wetter end of the White Fir Series. None of the dry site indicators, such as California black oak, poison oak, and salal, are present; but snow bramble, a cool, moist site indicator, is usually present. Herb cover is the highest of the Series and includes common Cascade Province species such as vanillaleaf, trail-plant, western twin-flower, and western starflower.

**ABIOTIC ENVIRONMENT:** ABCO/RUNI/ACTR is found between 3400 feet and 4800 feet, average for the Series, and from the top third to the bottom third of the slope. Slopes are average, ranging from 16 to 50 percent, and are dissected by 3.1 intermittent or larger streams per mile. Aspect is generally southerly, ranging from 108 degrees to 290 degrees. Parent materials are andesite or basalt and have produced deep soils. Total soil depth is 3.6 inches deeper than the Series average and total rooting depth is a minimum of 50 inches. ABCO/RUNI/ACTR has one of the greatest average basal areas per acre of the White Fir Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3966.0	596.0
Aspect (deg)	162.3	59.3
Slope (%)	25.7	14.8
Total soil depth (in)	45.6	8.1
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	340.0	85.6

**CLIMATE:** Temperatures are average, both maximum monthly and mean annual, for the Series; but the mean annual precipitation and average annual precipitation are greater than average for the Series. Relative to the Cascade Province, ABCO/RUNI/ACTR is of average temperature; but again, greater than average precipitation. Despite the greater than average precipitation, moisture is more limiting than

temperature in terms of productivity, survival, and growth.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.0	1.4
Maximum month temp (F)	78.8	2.4
Mean annual ppt (in)	62.9	9.9
Dry season ppt (in)	8.6	1.5

**FOREST FLOOR:** Litter cover is the lowest of the White Fir Associations and bareground, gravel, and rock cover are also below average. Bedrock and moss are above average. High moss covers are associated with warm temperatures. Decomposition rates are high when temperatures are warm and water is ample, but not at saturation. Decomposition, along with low intensity fire, may be responsible for lower amounts of litter found on most sites.

FOREST FLOOR	MEAN	S.D.
Litter (%)	82.0	21.9
Moss (%)	9.1	10.6
Bareground (%)	.4	.5
Gravel (%)	.6	1.1
Rock (%)	1.6	3.0
Bedrock (%)	.4	1.1

**VEGETATION:** Douglas-fir dominates the overstory, but white fir and incense-cedar are common. In the understory, white fir dominates, with Douglas-fir and incense-cedar common. Sugar pine, Douglas-fir, and incense-cedar are found on the warmer, drier sites and golden chinquapin on the shallow, rockier sites. Western hemlock is found on the wetter sites and Pacific yew is found in humid pockets.

White fir and Douglas-fir will invade after disturbance. Both are well suited for seeding on mineral soil. Under a canopy, white fir and, on some sites, western hemlock, typically establish themselves and are well suited for uneven age management.

Snow bramble and Pacific blackberry are found in all sampled stands, with dwarf Oregon grape, common prince's-pine, baldhip rose, creeping snowberry, and whipplevine occurring in the majority of stands. Vanillaleaf, pathfinder, western twinflower, and western starflower are usually present.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, and sugar pine are appropriate for regeneration. Rust resistant sugar pine should be used due to the presence of *Ribes* species in the Association. *Ribes* act as an alternate host during part of the life cycle of white blister rust fungus. In the spring, spores are windborne from sugar and white pines to *Ribes*, where they reproduce and reinfect *Ribes* throughout the summer. In the fall, the spores spread back to the pines, causing infections. The advanced regeneration of white fir would be suitable for inclusion in the next stand, if it can be protected from logging damage. White fir is highly susceptible to decay fungi following wounding. Western hemlock would be appropriate on cooler, moister sites. For diversity, Pacific yew would do well in areas of low evaporative demand and golden chinquapin on the rockier sites. Douglas-fir and white fir are the most productive species on the sites. The total basal area for **ABCO/RUNI/ACTR** is one of the highest of the White Fir Series with timber volume and biomass production moderate.

Total shrub cover ranges from 18 to 81 percent with an average of 46 percent, which is below the Series average of 51 percent. Most of the cover is from dwarf Oregon grape and common prince's-pine which will not significantly compete with seedlings. Herb cover is also below average for the Series, however, it ranges from 26 to 198 percent. On sites with heavy herb and grass cover, the potential for competition with seedlings following disturbance is high, but not directly proportional to cover.

**WATERSHED MANAGEMENT:** Precipitation ranges from 50 inches on the Prospect Ranger District to 80 inches on the Diamond Lake Ranger District, with an average of 62.9 inches. Most falls in the form of rain from the fall through the spring, with 7 to 11 inches falling during the dry season (May through September). Most samples were found on andesite or basalts, between 3400 and 4800 feet, on slopes from 5 to 50 percent. Soils generally have moderate infiltration rates, are very stable, and have

low risk of mass movement when harvested. Soil erosion potential is low, but soils may compact easily. (These are general guidelines are from the Rogue River National Forest and Umpqua National Forest Soil Resource Inventories. Refer to them for site specific information.)

Total shrub cover is low, but total herb and grass covers are the highest of the Series. Revegetation following disturbance would be moderately rapid. **ABCO/RUNI/ACTR** may be found anywhere on a slope, and possibly adjacent to, but not in, a riparian area.

**FIRE MANAGEMENT:** Evidence of fire was found on 3 of the 7 sample plots with a frequency of 130 to 300 years between intense, stand regenerating fires. Despite the greater than average precipitation, on the southerly aspect the fuels dry rapidly in years with low rainfall. Litter cover is low possibly due to higher decomposition rate and frequent, low intensity fires. White fir regeneration can provide a fuel ladder to the overstory.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited by the lack of palatable shrubs, but not by herbage. Browse species such as Pacific blackberry, California hazel, Pacific dogwood, dwarf bramble, snow bramble, thimbleberry, and creambush ocean-spray are sparsely scattered throughout the stands. Grass cover is the heaviest of the Series (3.3 percent). Water is frequently available with 3.1 intermittent or larger streams per mile.

Stands are mostly open, providing sparse thermal cover. Hiding cover is scattered in patches of conifer seedlings and saplings, hardwoods, and shrubs. There are a few snags and down logs scattered throughout the stands.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, **ABCO/RUNI/ACTR** is typical of the Cascades. It is generally found on mid slopes away from areas of recreational interest, such as stream bottoms or ridge tops with scenic viewpoints. There are no outstanding physical features and the potential for berry picking is low. Occasional vine maple patches provide color during the fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	42%	5.7	4.0	climax species
CADE3	incense-cedar	57%	8.8	7.5	
PILA	sugar pine	14%	1.0	.0	
PIPO	ponderosa pine	28%	3.0	2.8	
PSME	Douglas-fir	100%	61.4	19.9	
	TOTAL OVERSTORY	100%	69.9	15.0	evidence of fire history seral species
ABCO	—CONIFERS—				
ABCO	white fir	100%	33.6	26.3	climax species
CADE3	incense-cedar	85%	6.7	4.9	minor climax species
PILA	sugar pine	14%	2.0	.0	intermediate in light tolerance
PSME	Douglas-fir	71%	4.6	3.4	minor species at climax
TABR	Pacific yew	14%	38.0	.0	found in high humidity areas
TSHE	western hemlock	14%	20.0	.0	moister, northerly sites
	—HARDWOODS—				
ACCI	vine maple	28%	1.0	.0	
CACH	golden chinquapin	42%	4.3	2.1	rocky, well-drained soils
	TOTAL UNDERSTORY	100%	53.3	31.5	
AMAL	western serviceberry	14%	1.0	.0	deep, fertile soils
BENE	dwarf Oregongrape	85%	8.3	9.1	
BEPI	Piper's Oregongrape	14%	7.0	.0	
CHME	little prince's-pine	14%	1.0	.0	
CHUM	common prince's-pine	85%	9.0	10.7	
CONU	Pacific dogwood	14%	5.0	.0	moist, well-drained sites
COST	red-osier dogwood	14%	1.0	.0	
COCOC	California hazel	28%	1.5	.7	
HODI	creambush ocean-spray	42%	4.3	2.5	
PAMY	Oregon boxwood	14%	1.0	.0	
RHMA	Pacific rhododendron	28%	4.0	1.4	moist conditions, well-drained soils
RIBI	Siskiyou gooseberry	14%	2.0	0	shallow, well-drained soils
RIVI	sticky currant	14%	15.0	.0	higher elevations, drier sites
ROGY	baldhip rose	85%	3.2	2.1	
RULA	dwarf bramble	14%	1.0	0	
RUNI	snow bramble	100%	2.3	2.6	
RUPA	thimbleberry	14%	3.0	.0	
RUUR	Pacific blackberry	100%	3.0	2.3	cool, moist forests
SYAL	common snowberry	14%	1.0	.0	
SYMO	creeping snowberry	85%	3.8	3.2	
VAME	thin-leaved huckleberry	28%	2.0	.0	
WHMO	whipplevine	85%	5.7	7.3	
	TOTAL SHRUB	100%	40.4	20.2	warm, dry slopes cool sites, well-drained, acidic soils

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	100%	25.4	28.2	moist areas on deep, well-drained soil
ADBI	trail-plant, pathfinder	100%	4.9	5.5	moist sites from sea level to mid elevations
ANDE	threeleaf anemone	71%	2.2	.8	cool, wet sites
ANLY2	Lyal anemone	14%	1.0	.0	
APAN	spreading dogbane	14%	1.0	0	
ARMA3	bigleaf sandwort	28%	1.0	.0	
ARLA	mountain arnica	14%	2.0	.0	
ASCA3	western wild ginger	14%	1.0	.0	
ASHA	marbled wild ginger	14%	3.0	.0	
CAPR3	California harebell	28%	1.0	.0	
CASC2	rough harebell	28%	8.5	9.2	
CLUN	queen's cup	57%	2.8	2.1	
COST2	hooded coral-root	28%	1.0	.0	
COCA	bunchberry	14%	1.0	.0	
DIHOO	Oregon fairybell	57%	1.5	1.0	
FRVEB	woods strawberry	85%	2.2	1.6	
GAAP	catchweed bedstraw	71%	1.0	.0	
GOOB	rattlesnake-plantain	71%	2.0	1.7	
HIAL	white-flowered hawkweed	71%	1.2	.4	
IRIS	iris spp.	14%	1.0	0	
LAPO	leafy peavine	14%	8.0	.0	fixes nitrogen
LIBOL	western twinflower	100%	31.6	34.1	
MOUN2	Indian-pipe	14%	1.0	.0	saprophyte
OSCH	mountain sweet-root	42%	1.0	.0	
PERA	leafy lousewort	14%	1.0	.0	
PHAD	woodland phlox	14%	1.0	0	
POMU	western sword-fern	14%	2.0	0	
PTAQ	bracken	57%	2.8	2.1	
PTAN	woodland pinedrops	14%	1.0	.0	
PYPI	whitevein pyrola	28%	1.0	.0	
PYSE	one-sided pyrola	28%	1.5	.7	
SADO	yerba buena	42%	1.0	.0	drier sites
SMST	starry false Solomon's-seal	57%	3.0	3.4	cool sites
SYRE	snow-queen	42%	2.3	1.5	
TITR	foamflower	42%	1.0	.0	cool, moist, deep fertile soils
TRLA2	western starflower	100%	1.6	5	
TROV	white trillium	28%	1.0	0	
VAHE	white inside-out-flr	71%	1.8	8	
VIAM	American vetch	42%	1.7	1.2	
VIAD	early blue violet	14%	2.0	.0	
VIGL	stream violet	57%	2.3	1.9	
VIOR2	round-leaved violet	57%	1.5	.6	
	TOTAL HERB	100%	89.6	66.9	
BROMU	brome spp.	14%	5.0	0	
BRPA	Pacific brome	42%	3.0	3.5	
FEOC	western fescue	14%	3.0	.0	
MESU	Alaska oniongrass	42%	1.3	6	
	TOTAL GRASS	100%	3.3	2.4	

**WHITE FIR / THIN-LEAVED HUCKLEBERRY / VANILLALEAF**  
*Abies concolor* / *Vaccinium membranaceum* / *Achlys triphylla*  
**ABCO/VAME/ACTR**

**EXTENT:** ABCO/VAME/ACTR occurs on the Prospect and Ashland Ranger Districts in Western Cascade Subprovince near the contact with the High Cascades. N = 5 plots.

**IDENTIFYING CHARACTERISTICS:** This Association is most similar to ABCO/RUNI/ACTR and ABCO/VAME/LIBOL. Absence of dwarf bramble and trail-plant, and the greatly reduced cover of vanillaleaf distinguishes it from ABCO/RUNI/ACTR (3 percent versus 28 percent). Infrequent occurrences of queen's cup and starry false Solomon's-seal, and reduced cover of thin-leaved huckleberry distinguish it from ABCO/VAME/LIBOL (5 percent versus 27 percent).

**ABIOTIC ENVIRONMENT:** ABCO/VAME/ACTR occurs on cool sites at low to mid elevations. Slopes are gentle to flat with southwest to north to north-east exposures. Soils are derived from basalt or pyroclastic pumice/ash. Rooting depth is deep (50+ inches) even though soil development may be shallow. Organic matter content on the site is moderate. The rich shrub and herb layers contribute to litter accumulation and the overall water holding capacity. See the discussion on the High Cascade Subprovince.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3690.0	645.0
Aspect (deg)	327.4	66.6
Slope (%)	19.0	17.4
Total soil depth (in)	32.1	24.5
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	252.0	61.0

**CLIMATE:** Moisture is the most limiting factor in the late growing season and becomes more significant on pyroclastic soils with low water holding capacity. Relatively cool temperatures for the Series and rooting into the sometimes buried basaltic horizons helps to ameliorate moisture stress during the latter portion of the growing season. Sites with shallow to no slope are frost prone, limiting plant survival. Summer daytime temperatures are warm to

hot, but humidity recovery and temperature fluctuations at night are great.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.5	1.9
Maximum month temp (F)	79.8	2.7
Mean annual ppt (in)	52.0	7.6
Dry season ppt (in)	7.0	1.2

**FOREST FLOOR:**

FOREST FLOOR	MEAN	S.D.
Litter (%)	91.0	12.3
Moss (%)	11.4	16.2
Bareground (%)	.2	.4
Gravel (%)	.0	.0
Rock (%)	9.2	20.0
Bedrock (%)	.0	.0

**VEGETATION:** White fir is the principal regenerating species. It will continue to dominate all layers of the stand. However, a rich blend of additional conifers will co-occur at later seral stages: Douglas-fir, western hemlock, Pacific yew, incense-cedar, and western white pine. Golden chinquapin is usually a predominant part of the understory. Both the shrub and herb layers are species rich. Thin-leaved huckleberry, dwarf Oregongrape, creeping snowberry, and Oregon boxwood are the most frequently found shrubs. Vanillaleaf, western twinflower, and whitevein pyrola are the common herbs.

Western hemlock and Pacific yew indicate the mesic characteristics of the site. Western white pine, thin-leaved huckleberry, and whitevein pyrola indicate the cool nature of some microsites.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, and western white pine are appropriate for regeneration. Although there are no *Ribes* species found in this Association, white pine blister rust is a consideration in species management. The common advanced regeneration of white fir is significant, but risky to take advantage of because of its

susceptibility to rot from activity damage. Douglas-fir and white fir are the most productive species for most sites. Overall biomass production for ABCO/VAME/ACTR is less than the Series mean.

Pacific yew management may help to determine harvest systems. Since it is slowing growing, care should be taken to protect it during management activities. Vegetation management is not a significant concern. Activities which disturb the soil surface should be avoided, particularly on pumice/ash where nutrient availability is significantly restricted to the top few inches.

**WATERSHED MANAGEMENT:** Most precipitation falls as rain from fall through spring, with 7 inches falling during the dry season (May through September). Erosion potential is greatest on moderately sloped pyroclastics. The abundance of forest floor vegetation and litter reduces soil erosion potential, so disturbance of the soil surface will enhance the probability of soil movement and loss of soil nutrients. Percolation and infiltration rates are highest on the pyroclastics, although hydrophobic patches may be found on all sites.

**FIRE MANAGEMENT:** Fire does not affect the character of these stands significantly. Lightning ignited fires will normally occur, fizzling around in the understory. Two of the six stands sampled displayed

signs of past fire; one was approximately 85 years before present. Fire intensities in natural stands will normally range from low to moderate, with below average rates of spread. Mortality will not be significant unless the fire occurs during an episode of extreme droughty conditions. Fuel accumulation rates are moderate because the overall site productivity is low. However, environmental conditions are conducive to high decomposition rates.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited by the lack of palatable browse and low herb cover on most sites. Browse species such as California hazel, Pacific dogwood, dwarf bramble, and trailing blackberry are sparsely scattered throughout the stands. Grass cover is low (1.4 percent). Intermittent or permanent streams usually occur within a mile.

Both forest floor and stand structure are diverse. Stands provide good hiding cover of regeneration and shrubs. ABCO/VAME/ACTR has the greatest understory cover (124 percent) within the Series, primarily white fir and golden chinquapin.

**RECREATION & VISUAL MANAGEMENT:** The complete stand structure, from understory reproduction to overstory dominants, makes these stands aesthetically pleasing.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	60%	29.0	12.2	
PILA	sugar pine	40%	3.0	.0	
PIMO	western white pine	40%	5.0	2.8	
PSME	Douglas-fir	80%	43.7	22.9	
	TOTAL OVERSTORY	100%	55.6	12.0	
	—CONIFERS—				
ABCO	white fir	100%	49.0	21.9	climax species
CADE3	incense-cedar	60%	7.0	6.9	minor species at late seral stages
PILA	sugar pine	20%	2.0	.0	somewhat drought tolerant
PIMO	western white pine	60%	4.7	1.5	frost tolerant
PSME	Douglas-fir	60%	10.0	5.0	
TABR	Pacific yew	60%	10.0	2.0	found in pockets of high humidity
TSHE	western hemlock	60%	10.0	9.2	indicates mesic site conditions
	—HARDWOODS—				
ACGL	Douglas maple	20%	10.0	.0	
CACH	golden chinquapin	100%	48.0	24.1	rocky, shallow soils
	TOTAL UNDERSTORY	100%	124.4	12.2	
AMAL	western serviceberry	40%	1.5	.7	
ARNE	pinemat manzanita	20%	2.0	.0	
BENE	dwarf Oregongrape	80%	10.5	8.3	
CEVE	snowbrush	20%	2.0	.0	indicates recent fire history
CHME	little prince's-pine	20%	1.0	.0	
CHUM	common prince's-pine	80%	7.5	4.2	
CONU	Pacific dogwood	80%	7.0	1.8	
COCOC	California hazel	80%	10.5	6.1	warm sites on well-drained soils
GAOV	slender salal	20%	2.0	.0	cool, moist areas
PAMY	Oregon boxwood	80%	2.5	1.0	
ROGY	baldhip rose	60%	2.7	1.5	
RULA	dwarf bramble	20%	2.0	.0	
RUUR	Pacific blackberry	60%	2.3	1.2	
SOSI	Sitka mountain-ash	20%	2.0	.0	
SYMO	creeping snowberry	60%	2.3	2.3	
VAME	thin-leaved huckleberry	100%	5.2	4.9	cool sites
WHMO	whipplevine	20%	15.0	0	
	TOTAL SHRUB	100%	45.8	16.4	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	80%	3.5	2.4	cooler, more moist sites than ARCO
ALVI	candystick	20%	2.0	.0	
ANDE	threeleaf anemone	20%	2.0	.0	
APAN	spreading dogbane	20%	1.0	.0	
ARLA	mountain arnica	40%	1.5	.7	
CASC2	rough harebell	20%	1.0	.0	
CLUN	queen's cup	40%	1.0	.0	
COHE	varied-leaved collomia	20%	1.0	.0	
CYGR	Pacific hound's-tongue	20%	8.0	.0	
DIHOO	Oregon fairybell	40%	1.0	.0	
GOOB	rattlesnake-plantain	40%	1.0	.0	
HIAL	white-flowered hawkweed	40%	1.5	.7	
IRIS	iris spp.	20%	1.0	.0	
LAPO	leafy peavine	20%	2.0	.0	
LIBOL	western twinflower	80%	21.0	19.2	
PERA	leafy lousewort	20%	1.0	.0	
PHAD	woodland phlox	40%	1.0	.0	
PTAQ	bracken	60%	3.0	2.0	
PYAS	alpine pyrola	20%	1.0	0	abundance indicates relatively little soil drought
PYPI	whitevein pyrola	100%	1.0	.0	
PYSE	one-sided pyrola	20%	2.0	.0	
SMST	starry false Solomon's-seal	20%	1.0	.0	
SYRE	snow-queen	40%	2.0	.0	
TRLA2	western starflower	60%	1.7	6	
TROV	white trillium	20%	1.0	.0	
VAHE	white inside-out-flr	40%	11.0	12.7	
VIAM	American vetch	20%	2.0	.0	
VIGL	stream violet	20%	2.0	.0	
VIOR2	round-leaved violet	20%	1.0	.0	cool conditions
	TOTAL HERB	100%	37.4	28.6	
BRPA	Pacific brome	20%	1.0	.0	
CAREX	sedge spp.	20%	1.0	.0	
FEOC	western fescue	20%	5.0	0	
	TOTAL GRASS	100%	1.4	2.2	

**WHITE FIR / THIN-LEAVED HUCKLEBERRY / WESTERN TWINFLOWER**  
*Abies concolor* / *Vaccinium membranaceum* / *Linnaea borealis longiflora*  
**ABCO/VAME/LIBOL**

**EXTENT:** ABCO/VAME/LIBOL is found on the Ashland and Butte Falls Ranger Districts, Rogue River National Forest. N = 12 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/VAME/LIBOL is most similar to ABCO/VAME/ACTR. In ABCO/VAME/LIBOL Pacific yew, thin-leaved huckleberry and prince's-pine are usually present. The cover of Pacific yew (27 percent) and thin-leaved huckleberry (27 percent) is much higher than in ABCO/VAME/ACTR. In ABCO/VAME/ACTR Pacific yew averages 10 percent when it is present and the cover of thin-leaved huckleberry is 5 percent. Vanillaleaf is absent in ABCO/VAME/LIBOL and is present with an average cover of 4 percent in ABCO/VAME/ACTR.

**ABIOTIC ENVIRONMENT:** ABCO/VAME/LIBOL is found at the highest elevations of the White Fir Series, above 4700 feet, on the upper to middle third of slopes. Aspects are generally northerly. Slopes are more gentle than average for the Series (27.8 percent) and are dissected by an average of one stream per mile. Parent materials are andesite and basalt and soils are the deepest of the Series, both in rooting and total soil depth. Total basal area is below average for the White Fir Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4842.0	112.0
Aspect (deg)	326.7	74.0
Slope (%)	14.4	12.3
Total soil depth (in)	47.6	5.90
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	245.0	68.3

**CLIMATE:** Relative to the Series and to the Cascade Province, ABCO/VAME/LIBOL is located at the cool, dry end of the environmental grid. Temperatures are among the lowest of the White Fir Associations, both in mean annual and maximum monthly measurements. Precipitation is also among the lowest of the Series, with mean annual precipitation 10 inches less than the Series average, and dry season precipitation 1 inch less. Low soil and air tempera-

tures combined with moisture limitation late in the growing season limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.5	.3
Maximum month temp (F)	75.2	.5
Mean annual ppt (in)	43.7	4.3
Dry season ppt (in)	6.6	.5

**FOREST FLOOR:** Litter is slightly greater than the Series average of 93 percent and moss cover is much less than average, due to the cold temperatures limiting both decomposition rate and moss growth.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.5	5.4
Moss (%)	2.4	1.4
Bareground (%)	.9	2.3
Gravel (%)	.3	.6
Rock (%)	2.7	1.9
Bedrock (%)	.0	.0

**VEGETATION:** White fir dominates the overstory with Douglas-fir slightly less abundant. Shasta red fir and western white pine are common on the colder sites. The understory is predominately white fir, Pacific yew, and golden chinquapin. Douglas-fir and western white pine are common. Western white pine indicates colder sites; Pacific yew sites with high humidity; Douglas-fir and sugar pine warmer sites and golden chinquapin warmer, shallow, rockier sites. White fir and Douglas-fir will invade after a disturbance. Both are well suited for seeding on mineral soil, however, on frosty sites Douglas-fir will not survive and grow as well as western white pine.

Common prince's-pine and thin-leaved huckleberry are usually present and dwarf Oregon grape, Oregon boxwood, and baldhip rose are common. Thin-leaved huckleberry indicates cold environments and thrives after disturbance. The herb layer is rich with threeleaf anemone, queen's cup, western twinflower, and white inside-out-flower usually present.

Rattlesnake-plantain, starry Solomon-plume, western starflower, and white trillium are common.

**SILVICULTURE:** White fir, Douglas-fir, western white pine, sugar pine, and Pacific yew are appropriate for regeneration. On the colder, frost prone sites western white pine should be favored, however, *Ribes* species may be present in the stands, so blister rust is a consideration. On the relatively warmer, drier microsites, Douglas-fir and sugar pine would be well adapted. For diversity, Pacific yew would do well in areas of high humidity, and golden chinquapin on the rockier spots. Advance regeneration can be utilized in reforestation if injury is minimized. The potential for natural regeneration is estimated to be moderate. White fir and Douglas-fir would be the best producers on the site. The average basal area for ABCO/VAME/LIBOL is 245 square feet, slightly below average for the Series.

Total shrub cover ranges from 31 to 114 percent with an average of 70 percent. The majority of the cover is thin-leaved huckleberry, with dwarf Oregon-grape and common prince's-pine the next most common species. Chinquapin averages 17 percent cover and will provide competition, particularly in the rocky areas. Thin-leaved huckleberry will provide competition for moisture, however, it does not do well when initially exposed to full sunlight following management activities. Total herb cover is also above average for the Series and ranges from 34 to 124 percent. In those areas with heavy herb cover, resource availability will be a problem.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 50 inches with an average of 43.7 inches. The majority falls as rain and snow from fall through spring with only 6 to 7 inches falling during the dry season (May through September).

Most of the sample plots are located on andesites and basalts between 4700 and 5000 feet in elevation with gentle slopes (0 to 45 percent). These soils are stable, have moderate infiltration rates, and a low risk of mass movement when harvested. Compaction as a result of management activities can lessen survival and growth. (See the Rogue River National Forest SRI for site specific information.)

Total shrub and herb cover are above average for the White Fir Series and revegetation of disturbed sites should be moderately rapid. ABCO/VAME/LIBOL is mostly found on the middle to upper third of slopes, but may be found in intermittent stream bottoms.

**FIRE MANAGEMENT:** There was no evidence of fire noted on any of the sample plots. Stand ages ranged from 180 to 280 years, with ages of 270 to 280 on 4 of the 12 plots. Found at the higher elevations with lower temperatures, the fuels dry slowly and indicate an infrequent fire regime with intense, stand regenerating fires. White fir, Pacific yew, and golden chinquapin regeneration provide a fuel ladder to the overstory.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with a scattering of palatable shrubs and a moderate to high herbaceous cover (69 percent) for the Series. Browse species such as Pacific dogwood, California hazel, dwarf bramble, thimbleberry, salmonberry, and trailing blackberry are sparsely scattered throughout the stands. Grass cover is 1.6 percent, less than average for the Series. Water sources are scarce with only 1 intermittent or larger creek per mile.

The structure of the stands is typical of this Series. A few are more open and parklike with white fir regeneration, however, the majority are more broken up. Openings with patches of regeneration and hardwoods, particularly chinquapin, occur providing hiding cover interspersed with thermal cover. Down woody material and a few snags occurred in the stands sampled.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, this Association is typical of the Cascades. It is generally found on the middle to upper third of the slopes, though occasionally in a draw. Scenic vistas are infrequent but within the stands themselves there is some visual variety with openings of regeneration scattered throughout. Thin-leaved huckleberry may provide berry picking opportunities. Pacific dogwood and vine maple provide color in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	100%	32.8	17.0	indicates cold, moderate conditions indicates cold conditions warmer sites
ABMAS	Shasta red fir	33%	12.7	8.4	
PIMO	western white pine	58%	9.1	8.2	
PSME	Douglas-fir	91%	20.4	17.4	
	TOTAL OVERSTORY	100%	61.1	13.0	
ABCO	—CONIFERS—				susceptible to blister rust frost tolerant warmer sites sites with high humidity
	white fir	100%	24.1	11.3	
PILA	sugar pine	8%	2.0	.0	
PIMO	western white pine	41%	2.0	1.0	
PSME	Douglas-fir	58%	5.4	5.2	
TABR	Pacific yew	100%	27.4	17.6	shallow, rocky sites without cold air accumulation
	—HARDWOODS—				
ACGL	Douglas maple	16%	3.0	.0	
CACH	golden chinquapin	100%	16.9	18.9	
	TOTAL UNDERSTORY	100%	73.1	15.0	
AMAL	western serviceberry	25%	7.7	10.7	dry, cool to warm
ARNE	pinemat manzanita	8%	15.0	.0	
BENE	dwarf Oregon grape	91%	18.6	19.9	
CHUM	common prince's-pine	100%	5.9	3.3	
CONU	Pacific dogwood	8%	15.0	.0	
COCOC	California hazel	16%	8.5	9.2	moist conditions, cool sites, generally well-drained soils
PAMY	Oregon boxwood	83%	2.8	2.2	
RIBI	Siskiyou gooseberry	8%	1.0	.0	
RICE	squaw currant	8%	1.0	.0	
RILA	swamp gooseberry	8%	1.0	.0	
RILO	gummy gooseberry	33%	6.0	6.2	moist conditions
RIVI	sticky currant	33%	5.0	2.9	
ROGY	baldhip rose	91%	4.3	3.6	
RULA	dwarf bramble	8%	1.0	.0	
RUPA	thimbleberry	25%	1.3	.6	
RUSP	salmonberry	8%	1.0	.0	cool sites, well-drained, acidic soils
RUUR	Pacific blackberry	25%	1.0	.0	
SALIX	willow spp.	8%	5.0	0	
SOSI	Sitka mountain-ash	8%	1.0	.0	
SYAL	common snowberry	16%	1.5	.7	
SYMO	creeping snowberry	33%	4.8	3.6	
VAME	thin-leaved huckleberry	100%	26.8	21.7	
	TOTAL SHRUB	100%	70.2	28.5	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACMI	common yarrow	8%	1.0	.0	thrives in dry, disturbed areas
ADBI	trail-plant, pathfinder	50%	2.0	1.1	
ANDE	threeleaf anemone	100%	3.6	1.8	wet, cool sites
ANLY2	Lyll anemone	25%	1.0	.0	
ARMA3	bigleaf sandwort	25%	1.3	.6	
ASCA3	western wild ginger	16%	2.0	.0	
ASHA	marbled wild ginger	8%	4.0	.0	
CABU2	fairy-slipper	41%	1.0	.0	
CASC2	rough harebell	33%	1.5	.6	
CIRSI		8%	1.0	.0	
CLUN	queen's cup	100%	5.6	4.3	well-drained soils, generally on sites with frost and deep snowpack
COST2	hooded coral-root	58%	1.1	.4	
DIFO	Pacific bleedingheart	16%	1.0	.0	
DIHOO	Oregon fairybell	58%	1.1	.4	
FRVEB	woods strawberry	58%	2.3	2.6	
GAAP	catchweed bedstraw	41%	1.2	.4	
GOOB	rattlesnake-plantain	83%	1.0	.0	
HEUCH		8%	1.0	.0	
HEMI	smallflower alumroot	8%	2.0	.0	
HIAL	white-flowered hawkweed	50%	1.3	.8	
LAPO	leafy peavine	16%	2.0	1.4	
LIBOL	western twinflower	100%	35.7	24.5	abundance indicates relatively little soil drought
LICA3	northwest listera	8%	1.0	.0	
MITR2	three-tooth mitrewort	41%	1.2	.4	cool forest settings
MOSI	candyflower	25%	1.0	.0	
MOSIS	candyflower	8%	1.0	.0	
NEHE	small white nemophila	16%	1.0	.0	
OSCH	mountain sweet-root	16%	1.0	.0	
PERA	leafy lousewort	33%	1.3	.5	
POMU	western sword-fern	8%	2.0	.0	
PTAQ	bracken	8%	1.0	.0	
PYAP	leafless pyrola	8%	1.0	.0	
PYPI	whitevein pyrola	16%	1.0	.0	
PYSE	one-sided pyrola	66%	2.4	1.7	prefers a thick duff layer
RUAC	sheep sorrel	8%	1.0	.0	
SMST	starry false Solomon's-seal	91%	3.4	3.2	generally cool sites
SYRE	snow-queen	66%	2.3	1.6	
TITR	foamflower	8%	2.0	.0	
TRLA2	western starflower	83%	2.0	1.8	
TROV	white trillium	91%	1.9	2.1	moist sites
VAHE	white inside-out-flr	100%	2.6	2.1	warm, moist sites, lower elevations
VETH	common mullein	8%	1.0	.0	
VERON		8%	1.0	.0	
VIGL	stream violet	33%	1.3	.5	
VIOR2	round-leaved violet	16%	2.0	.0	
	TOTAL HERB	100%	69.7	27.7	
BRPA	Pacific brome	41%	1.4	.9	
CAREX	sedge spp.	16%	2.0	1.4	
FEOC	western fescue	25%	1.3	.6	
MESU	Alaska oniongrass	16%	1.5	.7	
	TOTAL GRASS	100%	1.6	1.4	

**WHITE FIR / VINE MAPLE / VANILLALEAF**  
*Abies concolor* / *Acer circinatum* / *Achlys triphylla*  
**ABCO/ACCI/ACTR**

**EXTENT:** ABCO/ACCI/ACTR is found on the North Umpqua, Tiller and Prospect Ranger Districts. N = 11 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/ACCI/ACTR is near the middle of the White Fir Series environmentally. Indicators of cold sites such as mountain hemlock, Pacific silver fir, and Shasta red fir are absent as are the hot site indicators such as California black oak and poison oak. Vine maple is usually present at high covers (average cover is 62 percent), but Pacific rhododendron is rare and salal absent.

**ABIOTIC ENVIRONMENT:** ABCO/ACCI/ACTR is found between 3200 feet and 4800 feet on all aspects and all slope positions from the upper third to the lower third. The slopes are moderately dissected with 2.6 intermittent or greater streams per mile. Parent material may be andesite, basalt, or tephra. Soils are shallow with total soil depth 6.6 inches less than the Series average, and rooting depth 5 inches less. Total basal area is average for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4274.0	479.0
Aspect (deg)	49.4	92.9
Slope (%)	36.9	18.4
Total soil depth (in)	34.4	12.2
Rooting depth (in)	41.3	11.1
Total basal area (ft <sup>2</sup> /ac)	298.2	89.6

**CLIMATE:** Temperatures are slightly cooler than average for the Series and the precipitation is slightly greater. Relative to the Cascade Province, ABCO/ACCI/ACTR is of cooler temperatures but average precipitation. Moisture is available through the early part of the summer, but it becomes limiting in the mid summer before low temperatures decrease biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.9	.7
Maximum month temp (F)	77.4	1.9
Mean annual ppt (in)	58.0	8.6
Dry season ppt (in)	7.9	1.4

**FOREST FLOOR:** Litter cover is above the Series average and moss cover is below. This combination of higher litter cover and lower moss cover is indicative of a slightly cooler environment, where decomposition rates are slower and growing conditions for moss are less than optimum.

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.0	4.2
Moss (%)	6.0	6.2
Bareground (%)	.6	.5
Gravel (%)	3.1	5.8
Rock (%)	1.9	1.7
Bedrock (%)	.4	1.2

**VEGETATION:** Douglas-fir dominates the overstory, white fir is common and western white pine rare. In the understory, white fir dominates with vine maple abundant (average cover 62 percent). Douglas-fir is common with occasional incense-cedar, sugar pine, Pacific yew, western hemlock, Douglas maple, Pacific madrone, golden chinquapin, and canyon live oak. Pacific yew is found on sites with high humidity; Douglas-fir, sugar pine, and canyon live oak are found on the warmer sites. Pacific madrone indicates fire during stand development and golden chinquapin shallow, rocky sites. The heavy cover of vine maple gives this Association one of the highest understory covers in the White Fir Series. White fir, Douglas-fir, sugar pine, western hemlock, and incense cedar will invade after a disturbance. All are well suited for seeding on mineral soil.

In the shrub layer, dwarf Oregongrape is abundant and baldhip rose is common. The herb layer has one of the highest average covers of the White Fir Series. Vanillaleaf is usually present and abundant

with trail-plant, catchweed bedstraw, western starflower, and white inside-out-flower common.

**SILVICULTURE:** White fir, Douglas-fir, western hemlock, sugar pine, and incense cedar are appropriate for regeneration. On the warmer sites, Douglas-fir, sugar pine, and incense cedar would be well adapted. Western hemlock would be appropriate within its natural range, from the middle of the Butte Falls Ranger District to the north. Advanced regeneration can be utilized in reforestation if injury is minimized. The potential for natural regeneration is estimated to be moderate. White fir and Douglas-fir would be the most productive species on the site. The total basal area for ABCO/ACCI/ACTR is the same as the average for the White Fir Series.

Total shrub cover ranges from 9 to 65 percent with an average of 35 percent. The cover of vine maple ranges from 10 to 110 percent with an average of 62 percent and will be the major competitor on the site. The herb layer is also the heaviest of the White Fir Series and has the potential to compete with seedlings for moisture.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 45 to 70 inches with an average of 58 inches. Most occurs as rain from fall through the spring, with only 6 to 10 inches falling during the dry season (May through September). ABCO/ACCI/ACTR is found mainly on andesites and basalts, though it has been found on tephra. Because of the range of conditions on which it is found, it is not appropriate to generalize soil characteristics. Revegetation following disturbance should be about average for the Series. ABCO/ACCI/

ACTR is generally found on slopes from the upper third to the lower third and not in riparian areas.

**FIRE MANAGEMENT:** Evidence of fire was noted on 2 of the 11 sample plots. Stand ages ranged from 150 to 260 years. One plot containing Pacific madrone had a fire about 45 years ago. Light underburns occur occasionally, however, the majority of fires appear to be intense and stand regenerating.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with a scattering of palatable shrubs and a high herbaceous cover (75 percent) for the Series. Browse species such as red huckleberry, trailing blackberry, deerbrush, Pacific dogwood, California hazel, dwarf bramble, snow bramble, and thimbleberry are sparsely scattered throughout the stands. Grass cover is 1.5 percent, less than average for the Series. Water sources are frequent with 2.5 intermittent or larger creeks per mile.

The structure of the stands is typical of this Series. Most have openings with heavy vine maple cover and white fir regeneration that provide excellent hiding cover. Snags and down logs are scattered throughout the stands.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, this Association is typical of the Cascades. It is generally found on slopes and away from areas of recreational interest such as stream bottoms or ridgetops. There are no outstanding features and the potential for berry picking is low. Pacific dogwood and vine maple provide brilliant color and contrast in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	63%	12.4	4.4	
PIMO	western white pine	9%	4.0	.0	
PSME	Douglas-fir	100%	59.1	13.0	
	TOTAL OVERSTORY	100%	67.4	17.9	
	—CONIFERS—				
ABCO	white fir	100%	21.5	12.1	climax
CADE3	incense-cedar	9%	10.0	.0	
PILA	sugar pine	9%	2.0	.0	warmer sites
PSME	Douglas-fir	36%	10.5	7.9	seral species and a minor component of the stand at later seral stages
TABR	Pacific yew	18%	3.5	3.5	high humidity sites
TSHE	western hemlock	18%	17.5	3.5	relatively warmer, wetter sites
	—HARDWOODS—				
ACCI	vine maple	100%	61.8	35.7	major competitor with other species
ACGL	Douglas maple	9%	1.0	.0	
ARME	Pacific madrone	9%	7.0	.0	indicates recent fire history
CACH	golden chinquapin	9%	5.0	.0	shallow, rocky sites
QUCH	canyon live oak	9%	1.0	.0	indicates dry, warm site
	TOTAL UNDERSTORY	100%	93.3	36.1	
AMAL	western serviceberry	9%	2.0	0	deep, fertile soils
BENE	dwarf Oregongrape	81%	17.1	13.9	
BEPI	Piper's Oregongrape	27%	2.0	1.0	
CEIN	deerbrush	9%	3.0	.0	
CHME	little prince's-pine	45%	3.4	4.8	
CHUM	common prince's-pine	54%	5.7	5.2	
CONU	Pacific dogwood	9%	1.0	.0	
COCOC	California hazel	18%	2.0	1.4	
HODI	creambush ocean-spray	9%	3.0	.0	
PAMY	Oregon boxwood	9%	1.0	.0	
RHMA	Pacific rhododendron	18%	3.0	.0	
RIBES	currant spp.	9%	1.0	.0	
RILA	swamp gooseberry	18%	9.0	1.4	
ROGY	baldhip rose	81%	3.1	2.4	
RULA	dwarf bramble	18%	1.5	.7	
RUNI	snow bramble	45%	2.2	1.1	cool, moist forests
RUPA	thimbleberry	18%	6.0	5.7	
RUUR	Pacific blackberry	63%	3.0	1.4	common in disturbed areas
SYMO	creeping snowberry	54%	3.2	3.9	
VAME	thin-leaved huckleberry	36%	4.3	2.5	
VAPA	red huckleberry	18%	3.5	2.1	
WHMO	whipplevine	27%	4.0	1.7	
	TOTAL SHRUB	100%	35.1	17.6	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	100%	17.8	21.3	moist sites, usually on deep, well-drained soil
ACRU	baneberry	54%	3.7	3.4	
ADBI	trail-plant, pathfinder	81%	4.3	6.1	
AGUR	nettle-leaf horse-mint	9%	1.0	.0	
ANDE	threeleaf anemone	72%	1.3	.5	
ARMA3	bigleaf sandwort	9%	1.0	.0	
ARCO	heart-leaf arnica	9%	4.0	.0	
ARLA	mountain arnica	45%	3.6	4.8	
ASCA3	western wild ginger	63%	2.6	2.7	
ASHA	marbled wild ginger	18%	1.5	.7	
CAPR3	California harebell	36%	2.0	1.4	wet, cool sites
CASC2	rough harebell	36%	2.3	1.5	
CIAL	alpine circaea	9%	1.0	.0	
CLUN	queen's cup	72%	2.5	2.3	
COLA	cutleaf goldthread	9%	5.0	.0	
COMA3	spotted coral-root	27%	1.0	.0	
COST2	hooded coral-root	9%	1.0	.0	
COCA	bunchberry	9%	10.0	.0	
DIFO	Pacific bleedingheart	18%	1.0	.0	
DIHOO	Oregon fairybell	72%	5.8	7.9	generally moist or shaded areas
FRVEB	woods strawberry	18%	1.0	.0	
GAAP	catchweed bedstraw	81%	1.3	.5	
GAOR	Oregon bedstraw	45%	1.6	.9	
GOOB	rattlesnake-plantain	54%	1.2	.4	
HIAL	white-flowered hawkweed	54%	1.5	1.2	
LAPO	leafy peavine	27%	5.3	4.2	
LWA	Washington lily	9%	1.0	.0	
LIBOL	western twinflower	54%	25.2	27.7	
LICA3	northwest listera	9%	1.0	.0	
MOSI	candyflower	27%	1.7	1.2	
NEHE	small white nemophila	9%	1.0	.0	
OSCH	mountain sweet-root	63%	1.0	.0	
PERA	leafy lousewort	18%	1.0	.0	
PHAD	woodland phlox	27%	1.3	.6	
POMU	western sword-fern	45%	4.0	3.7	
PTAQ	bracken	9%	3.0	.0	
PYAP	leafless pyrola	9%	1.0	.0	
PYPI	whitevein pyrola	9%	2.0	.0	
PYSE	one-sided pyrola	36%	1.0	.0	generally cooler sites
SMRA	western false Solomon's-seal	27%	1.0	.0	
SMST	starry false Solomon's-seal	63%	3.4	3.0	
SYRE	snow-queen	45%	1.6	1.3	
TITR	foamflower	63%	4.4	2.8	
TRLA2	western starflower	81%	2.0	1.2	
TROV	white trillium	45%	1.0	.0	
VAHE	white inside-out-flr	90%	1.7	.7	
VECA	Calif. false hellebore	9%	1.0	.0	
VIAM	American vetch	27%	1.7	.6	cool, moist, deep fertile soils mid successional
VIGL	stream violet	54%	1.7	.5	
VIOR2	round-leaved violet	18%	1.5	.7	
	TOTAL HERB	100%	74.5	30.3	
BRPA	Pacific brome	36%	1.5	.6	
FEOC	western fescue	27%	1.0	.0	
LUHI	smooth woodrush	18%	1.0	.0	
MESU	Alaska oniongrass	18%	2.5	.7	
	TOTAL GRASS	100%	1.5	.9	

**WHITE FIR / DWARF OREGONGRAPE - SALAL**  
*Abies concolor* / *Berberis nervosa* - *Gaultheria shallon*  
**ABCO/BENE-GASH**

**EXTENT:** ABCO/BENE-GASH occurs on the Diamond Lake, North Umpqua and Tiller Ranger Districts, Umpqua National Forest. N = 14 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of dwarf Oregongrape in combination with greater than 10 percent cover of salal or, if salal is absent, greater than 10 percent cover of Pacific rhododendron differentiates ABCO/BENE-GASH from other White Fir Associations.

**ABIOTIC ENVIRONMENT:** ABCO/BENE-GASH is found between 2500 and 4400 feet in elevation, on all aspects, from the ridgetops down to the lower third of the slopes. Slopes are moderate and are dissected with 3.1 intermittent or larger streams per mile. Parent materials include diorite, dacite, andesite, pumice and basalt. The soils are deeper than Series average (41.0 inches) in total soil depth but slightly shallower than the Series average (46.2 inches) in rooting depth. Total basal area is below average for the White Fir Series (290 square feet).

ABIOTIC	MEAN	S.D.
Elevation (ft)	3213.0	550.0
Aspect (deg)	322.4	95.8
Slope (%)	28.5	12.2
Total soil depth (in)	42.1	11.2
Rooting depth (in)	43.2	11.8
Total basal area (ft <sup>2</sup> /ac)	266.4	54.0

**CLIMATE:** Relative to the Series and to the Cascade Province, ABCO/BENE-GASH is located at the warm, moderate end of the environmental grid. Temperatures are greater than average for the Series, both in mean annual and maximum monthly measurements. Precipitation is also greater than average, both in mean annual and dry season measurements. Moisture limitations usually end the growing season or limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.7	1.6
Maximum month temp (F)	81.7	2.2
Mean annual ppt (in)	59.3	8.1
Dry season ppt (in)	8.1	1.6

**FOREST FLOOR:** Litter cover is slightly above the Series average and moss cover is much greater than the Series average (8.3 percent). The greater cover of moss is indicative of the higher mean annual temperature.

FOREST FLOOR	MEAN	S.D.
Litter (%)	94.4	5.1
Moss (%)	15.0	19.7
Bareground (%)	1.1	1.4
Gravel (%)	.8	1.4
Rock (%)	3.4	5.5
Bedrock (%)	.1	.3

**VEGETATION:** Douglas-fir dominates the overstory with sugar pine, incense-cedar, and white fir common. The understory is dominated by white fir with incense-cedar, Douglas-fir, sugar pine, and Pacific yew common. Ponderosa pine, western hemlock, and western redcedar are occasionally found in the understory. Ponderosa pine is found on the warmest sites; Pacific yew in areas of high humidity; western redcedar and western hemlock on the wetter sites; golden chinquapin on the shallow, rocky soils and Pacific madrone in areas with recent fire. White fir, Douglas-fir, incense-cedar, sugar pine, and western hemlock will invade after a disturbance as all are suited for seeding on mineral soil.

The shrub layer is the heaviest of the White Fir Series, with an average of 98.8 percent total shrub cover. Dwarf Oregongrape is usually present and salal, baldhip rose, Pacific blackberry, and whipplevine are common. Salal indicates a relatively warm environment. Herb cover is lower than the Series average (47.1 percent). The common herbs include Oregon fairybell, rattlesnake-plantain, and western twinflower.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, sugar pine, ponderosa pine, western red-cedar and western hemlock are appropriate for regeneration. Rust resistant sugar pine should be used due to the presence of *Ribes* species in the Association. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. Ponderosa pine would be appropriate on hot, dry sites or frost prone sites. Western redcedar and western hemlock would be appropriate on moister sites. For diversity, golden chinquapin would do well in rocky, shallow soils and Pacific yew in areas of high humidity. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO/BENE-GASH is slightly below average for the White Fir Series.

Total shrub cover ranges from 31 to 175 percent with an average of 98.8 percent, which is the highest shrub cover of the Series. Most of the cover is salal, dwarf Oregongrape, and Pacific rhododendron. Competition to seedlings will come mainly from the salal, Pacific rhododendron, Pacific dogwood, creambush ocean-spray, vine maple, and big-leaf maple. Herb cover at an average of 29 percent is slightly below average for the Series and ranges from 4 to 77 percent. Herbs will provide less competition with seedlings for moisture than the shrubs.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 45 to 70 inches with an average of 59.3 inches. The majority falls as rain from October through April with only 6 to 11 inches falling during the dry season (May through September). The Association is found on both andesite/basalt and pumice, so it is difficult to generalize soil characteristics. Shrub species and the high amount of shrub cover indicates revegetation following dis-

turbance will be rapid. ABCO/BENE-GASH is found on the ridgetops to lower third of the slopes and not in riparian or wet areas.

**FIRE MANAGEMENT:** Evidence of fire was noted on 5 of the 14 plots. The frequency was 140 to 340 years between intense, stand regenerating fires. Found from the ridgetops down to the lower third of the slopes, the sites are warmer and wetter than average for the Cascade province. Underburning occurs occasionally, however, the majority of fires are intense, stand regenerating fires.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with a scattering of palatable shrubs and low herbaceous cover. Browse species such as Pacific dogwood, creambush ocean-spray, dwarf bramble, snow bramble, thimbleberry, trailing blackberry, and red huckleberry are scattered throughout the stands. Grass cover is low (1.1 percent). Water is available with 3.1 intermittent or larger streams per mile.

Stands range from open to closed, with more closed stands providing thermal cover and more open stands providing hiding cover with patches of advanced white fir regeneration. Patches of rhododendron, vine maple, and big-leaf maple can also provide hiding cover. There are few snags and little down woody material.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, this Association is typical of the Cascades. It is generally found on gentle slopes but occasionally on the ridgetops, an area of greater recreational interest. There are no outstanding features and the potential for berry picking is low. Pacific dogwood and vine maple provide color in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	57%	13.7	9.7	cold, moderate conditions somewhat drought tolerant cold sites evidence of previous fire history warm, wet sites
ABMAS	Shasta red fir	7%	3.0	.0	
CADE3	incense-cedar	71%	9.4	3.9	
PILA	sugar pine	78%	9.7	5.4	
PIMO	western white pine	7%	5.0	.0	
PIPO	ponderosa pine	21%	6.0	3.6	
PSME	Douglas-fir	100%	41.7	12.9	
THPL	western redcedar	7%	4.0	.0	warm, wet sites
	TOTAL OVERSTORY	100%	66.1	11.5	
	---CONIFERS---				
ABCO	white fir	100%	31.8	14.7	climax species
CADE3	incense-cedar	78%	11.5	7.3	warmer, drier sites
PILA	sugar pine	42%	2.2	1.5	intermediate in light tolerance
PIPO	ponderosa pine	7%	5.0	.0	frost tolerant
PSME	Douglas-fir	50%	10.6	3.9	
TABR	Pacific yew	35%	8.0	7.4	indicates high humidity
THPL	western redcedar	7%	12.0	.0	warm, wet sites
TSHE	western hemlock	14%	22.5	3.5	warmer, wetter sites
	---HARDWOODS---				
ACCI	vine maple	35%	28.0	22.0	
ACMA	big-leaf maple	21%	16.7	16.1	moister sites
ARME	Pacific madrone	42%	7.5	5.5	evidence of fire history
CACH	golden chinquapin	64%	7.1	5.4	shallow, rocky soils
	TOTAL UNDERSTORY	100%	75.7	22.0	
AMAL	western serviceberry	7%	1.0	.0	deep, fertile soils drier, rockier, less productive than where BENE occurs moist sites warm and dry, well-drained sites hot, dry open slopes and forest with often rocky, well-drained soils shallow, well-drained soils
BENE	dwarf Oregongrape	100%	17.6	20.7	
BEPI	Piper's Oregongrape	7%	1.0	0	
CHME	little prince's-pine	21%	1.0	.0	
CHUM	common prince's-pine	50%	5.0	4.5	
CONU	Pacific dogwood	14%	11.5	4.9	
COST	red-osier dogwood	14%	1.5	7	
GASH	salal	85%	57.2	28.8	
HODI	creambush ocean-spray	42%	5.8	3.4	
LOHI	hairy honeysuckle	14%	1.5	.7	
PAMY	Oregon boxwood	7%	1.0	0	warm sites, sea level to mid elevation warm, dry slopes warm, dry sites often with rocky, well-drained soils
RHMA	Pacific rhododendron	42%	26.7	10.8	
ROGY	baldhip rose	92%	4.5	4.8	
RULA	dwarf bramble	7%	1.0	.0	
RUNI	snow bramble	21%	3.7	2.9	
RUPA	thimbleberry	7%	2.0	.0	
RUUR	Pacific blackberry	78%	2.2	1.4	
SYMO	creeping snowberry	64%	2.4	1.6	
VAME	thin-leaved huckleberry	21%	2.0	1.0	
VAPA	red huckleberry	21%	3.7	2.3	
WHMO	whipplevine	78%	4.5	2.1	warm, dry sites often with rocky, well-drained soils
	TOTAL SHRUB	100%	98.8	44.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	71%	3.0	2.4	moist sites, usually on deep, well-drained soil
ADBI	trail-plant, pathfinder	57%	1.6	.7	
ANDE	threeleaf anemone	42%	1.7	.8	
APAN	spreading dogbane	7%	1.0	.0	
ARMA3	bigleaf sandwort	14%	1.0	.0	
ARLA	mountain arnica	7%	1.0	.0	
ASHA	marbled wild ginger	14%	2.0	1.4	
CAPR3	California harebell	7%	4.0	.0	
CASC2	rough harebell	57%	1.6	.7	
CLUN	queen's cup	42%	1.3	.8	
COHE	varied-leaved collomia	14%	1.5	.7	
CYGR	Pacific hound's-tongue	7%	1.0	.0	
DIHOO	Oregon fairybell	78%	1.7	1.0	
EPMI	small-fl'd willow-herb	7%	1.0	.0	
FRVEB	woods strawberry	14%	1.0	.0	
GAAP	catchweed bedstraw	35%	1.0	.0	found everywhere except in hot, dry or extremely cold environments
GOOB	rattlesnake-plantain	78%	1.0	.0	
HAL	white-flowered hawkweed	50%	1.6	1.1	
IRCH	slender-tubed iris	7%	1.0	.0	
LAPO	leafy peavine	7%	2.0	.0	
LIAP	celery-ld licorice-rt	7%	1.0	.0	
LICO4	tiger lily	7%	1.0	.0	
LIBOL	western twinflower	85%	10.3	14.1	
LOMAT		7%	1.0	.0	
MAMA	woodland tarweed	21%	1.0	.0	
MOSI	candyflower	7%	1.0	.0	
NEHE	small white nemophila	14%	1.0	.0	
OSCH	mountain sweet-root	21%	1.3	.6	
PHAD	woodland phlox	14%	1.0	.0	generally productive sites
POMU	western sword-fern	50%	2.1	.9	
PSPH	California-tea	7%	1.0	.0	
PTAQ	bracken	21%	1.0	.0	
PYPI	whitevein pyrola	14%	1.0	.0	
PYSE	one-sided pyrola	7%	1.0	.0	
SADO	yerba buena	14%	1.0	.0	
SMRA	western false Solomon's-seal	7%	1.0	.0	
SMST	starry false Solomon's-seal	14%	1.0	.0	
SYRE	snow-queen	71%	2.6	2.9	
THMO	mountain thermopsis	7%	5.0	.0	
TITR	foamflower	14%	1.0	.0	
TRLA2	western starflower	57%	1.8	.7	
TROV	white trillium	21%	1.0	.0	warm, moist sites, lower elevations
VAHE	white inside-out-flr	57%	1.4	.7	
VECA	Calif. false hellebore	7%	1.0	.0	
VIAM	American vetch	7%	1.0	.0	
VIAD	early blue violet	14%	1.0	.0	
VIGL	stream violet	35%	2.0	.7	
VIOR2	round-leaved violet	35%	1.6	.9	
XETE	common beargrass	42%	4.0	2.8	
	TOTAL HERB	100%	29.0	18.3	
BRPA	Pacific brome	35%	1.0	.0	
CAREX	sedge spp.	7%	1.0	.0	
FEOC	western fescue	28%	1.0	.0	
FERU	red fescue	14%	1.5	.7	
	TOTAL GRASS	100%	1.1	1.0	

**WHITE FIR / DOUGLAS MAPLE / DWARF OREGONGRAPE**  
*Abies concolor* / *Acer glabrum* / *Berberis nervosa*  
**ABCO/ACGL/BENE**

**EXTENT:** **ABCO/ACGL/BENE** occurs on the Ashland and Butte Falls Ranger Districts, Rogue River National Forest. N = 10 plots.

**IDENTIFYING CHARACTERISTICS:** **ABCO/ACGL/BENE** can be most readily distinguished from other White Fir Associations by what is absent. Although Douglas maple is present; salal, Pacific rhododendron, California black oak, Pacific yew, snow bramble, vine maple, thin-leaved huckleberry, and Oregon boxwood are absent.

**ABIOTIC ENVIRONMENT:** **ABCO/ACGL/BENE** is found between 3500 feet and 4500 feet on the middle to upper third of slopes with mostly northwesterly aspects. Slopes can range from gentle (8 percent) to steep (85 percent) and are minimally dissected with 1.3 intermittent or larger streams per mile. Parent materials are andesite and basalt with one of the deepest total soil depths of the Series and a rooting depth deeper than the Series average (46.2 inches). Total basal area is below the Series average (290 square feet).

ABIOTIC	MEAN	S.D.
Elevation (ft)	4232.0	305.0
Aspect (deg)	325.7	66.3
Slope (%)	38.1	24.6
Total soil depth (in)	46.7	7.5
Rooting depth (in)	48.0	6.5
Total basal area (ft <sup>2</sup> /ac)	220.0	92.9

**CLIMATE:** Relative to the Series and to the Cascade Province, **ABCO/ACGL/BENE** is located at the cooler, drier end of the environmental grid. Temperatures are below average for the Series, both mean annual and maximum monthly. Precipitation is the lowest of the Series, both mean annual and dry season. Moisture is the most limiting factor to biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.9	.9
Maximum month temp (F)	77.5	1.3
Mean annual ppt (in)	41.5	6.3
Dry season ppt (in)	6.3	.5

**FOREST FLOOR:** Litter is slightly greater than the Series average of 93 percent and moss cover is much less than average, due to the cold temperatures.

FOREST FLOOR	MEAN	S.D.
Litter (%)	96.5	4.2
Moss (%)	3.2	4.4
Bareground (%)	1.1	2.5
Gravel (%)	.3	.5
Rock (%)	2.7	3.0
Bedrock (%)	1.0	3.2

**VEGETATION:** White fir and Douglas-fir dominate the overstory with incense-cedar, sugar pine, and ponderosa pine common. The understory is predominately white fir with Douglas-fir, incense-cedar, and Douglas maple common, and sugar pine and western white pine occasional. Western white pine indicates the colder sites; sugar pine warmer sites; and golden chinquapin warmer, shallower, rockier sites. White fir, sugar pine, Douglas-fir, and incense-cedar will invade after a disturbance. All are well suited for seeding on mineral soil.

Common shrubs include dwarf Oregongrape, California hazel, baldhip rose, common prince's-pine, Pacific blackberry, and creeping snowberry. Common herbs include threeleaf anemone, catchweed bedstraw, rattlesnake-plantain, starry false Solomon's-seal, white inside-out flower, western starflower and white trillium. All are common Cascade Province species.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, western white pine, and sugar pine are appropriate for regeneration. Western white pine would be appropriate on colder sites. Rust resistant

sugar pine should be used due to the presence of *Ribes* species. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. For diversity, golden chinquapin does well in rocky, shallow soils and big-leaf maple on moister sites. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO/ACGL/BENE is one of the lowest of the White Fir Series.

Total shrub cover ranges from 18 to 126 percent with an average of 53.2 percent, which is slightly greater than the Series average. Most of the cover is from dwarf Oregongrape, western serviceberry, California hazel, creambush ocean-spray, and creeping snowberry, the majority of which will compete with the seedlings for moisture. The presence of Piper's Oregongrape and trumpet honeysuckle indicates dry conditions. Douglas maple and big-leaf maple in the understory will also compete for moisture. Herb cover ranges from 13 to 108 percent with an average of 41.2 percent, slightly below the Series average, but high enough to affect water availability.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 30 to 50 inches with an average of 41.5 inches. This Association has the lowest mean annual precipitation of the White Fir Series. Most falls as rain from October through April, with only 6 to 7 inches falling during the dry season (May through September).

All of the sample plots were found on andesites and basalts between 3500 and 4500 feet on slopes ranging from 8 to 85 percent. These soils are usually well drained with moderate infiltration rates. The soils are rated as stable or very stable with a slightly increased chance of expected mass movement from management activities. The potential for soil erosion is slight to moderate and compaction may be a problem. (See the Rogue River National Forest SRI for site specific information.)

Shrub and herb cover is about average for the White Fir Series and the revegetation following disturbance should be average. ABCO/ACGL/BENE has been found in a basin or on the edge of a wetland.

**FIRE MANAGEMENT:** Fire evidence was found on 5 of the 10 plots. Stand ages range from 60 to 200 years with the last disturbances estimated at 60 and 95 years. ABCO/ACGL/BENE occurs on northwesterly slopes, with the lowest precipitation of the White Fir Series, and slightly less than average temperatures. In these conditions, fuels dry at a moderate rate. The majority of fires appear to be intense and stand regenerating, however, localized underburns also occur during dry years. White fir, Douglas-fir, and incense cedar provide a fuel ladder to the overstory particularly in the later successional stages.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with moderate cover of both palatable shrubs and herbs. Browse species, such as Pacific dogwood, California hazel, creambush ocean-spray, thimbleberry, salmonberry, and Pacific blackberry are scattered throughout the stands. Grass cover is 1.3 percent, less than average for the series. Water is available from the 1.3 intermittent or larger streams per mile.

The younger, denser stands may provide thermal cover, with the less dense stands providing hiding cover of white fir regeneration and shrubs. There are few snags and down logs.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, this Association is typical of the Cascades. It is generally found on moderate slopes and away from areas of recreational interest such as stream bottoms and ridgetops. There are no outstanding features and the potential for berry picking is low. Douglas maple, vine maple, and Pacific dogwood provide brilliant color and contrast in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	90%	31.4	11.7	warmer, drier sites somewhat drought tolerant evidence of fire history
CADE3	incense-cedar	30%	13.3	7.6	
PILA	sugar pine	40%	5.0	.0	
PIPO	ponderosa pine	20%	5.0	.0	
PSME	Douglas-fir	90%	36.1	22.0	
	TOTAL OVERSTORY	100%	67.8	17.1	
ABCO	—CONIFERS—				minor component of later seral stages susceptible to blister rust frost tolerant
ABCO	white fir	100%	32.4	16.6	
CADE3	incense-cedar	60%	6.5	9.2	
PILA	sugar pine	10%	1.0	.0	
PIMO	western white pine	10%	1.0	.0	
PSME	Douglas-fir	90%	10.4	6.7	
	—HARDWOODS—				moister sites shallow, rocky soils dry to moist and well-drained, sandy and gravelly
ACGL	Douglas maple	100%	4.7	3.6	
ACMA	big-leaf maple	20%	22.5	3.5	
CACH	golden chinquapin	20%	8.5	2.1	
PREM	bittercherry	10%	2.0	.0	
	TOTAL UNDERSTORY	100%	57.0	19.3	
AMAL	western serviceberry	40%	10.5	4.2	deep, fertile soils drier, rockier, less productive sites than where BENE occurs regeneration will be stimulated by fire
BENE	dwarf Oregongrape	90%	21.0	29.1	
BEPI	Piper's Oregongrape	30%	1.3	.6	
CEIN	deerbrush	10%	2.0	.0	
CHME	little prince's-pine	10%	1.0	0	
CHUM	common prince's-pine	70%	4.9	2.9	hot, dry site indicator
CONU	Pacific dogwood	40%	7.3	6.4	
COCOC	California hazel	90%	7.4	5.2	
HODI	creambush ocean-spray	50%	3.2	1.6	
LOCI	trumpet honeysuckle	20%	1.5	.7	
OECE	Indian plum	20%	2.5	2.1	moist to wet site indicator alternate host for blister rust
RHPU	cascara	10%	1.0	.0	
RIBES	currant spp.	10%	10.0	.0	
RILO	gummy gooseberry	10%	2.0	.0	
ROGY	baldhip rose	100%	4.6	4.1	
RUPA	thimbleberry	40%	1.8	1.0	tasty fruit moist site indicators
RUSP	salmonberry	10%	1.0	.0	
RUUR	Pacific blackberry	70%	2.6	1.1	
SALIX	willow spp.	10%	2.0	.0	
SYAL	common snowberry	10%	5.0	.0	
SYMO	creeping snowberry	90%	9.0	5.6	warm, dry slopes
WHMO	whipplevine	20%	3.0	.0	
	TOTAL SHRUB	100%	53.2	32.5	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	10%	3.0	0	
ADBI	trail-plant, pathfinder	60%	5.0	5.5	
ANDE	threeleaf anemone	90%	3.6	2.8	
ANLY2	Lyal anemone	10%	1.0	.0	
ARMA3	bigleaf sandwort	60%	1.2	.4	
ASHA	marbled wild ginger	30%	2.3	.6	
CABU2	fairy-slipper	10%	1.0	0	
CAPR3	California harebell	20%	1.0	.0	
CASC2	rough harebell	40%	2.0	2.0	
CLUN	queen's cup	30%	2.7	2.1	
COMA3	spotted coral-root	20%	1.0	0	
COST2	hooded coral-root	10%	1.0	0	
DIHOO	Oregon fairybell	60%	1.3	5	
EBAU	phantom-orchid	10%	1.0	.0	
FRVEB	woods strawberry	50%	2.6	1.1	
GAAP	catchweed bedstraw	90%	1.0	0	
GOOB	rattlesnake-plantain	70%	1.3	.5	
HEMI	smallflower alumroot	10%	1.0	.0	
HIAL	white-flowered hawkweed	30%	2.0	1.7	
LAPO	leafy peavine	50%	6.2	7.9	fixes nitrogen
LIBOL	western twinflower	50%	17.6	18.5	
LUAL	sickle-keeled lupine	10%	1.0	0	fixes nitrogen
MITR2	three-tooth mitrewort	40%	1.0	.0	
MOSI	candyflower	40%	1.0	0	
NEHE	small white nemophila	20%	1.0	.0	
OSCH	mountain sweet-root	40%	1.5	.6	
PERA	leafy lousewort	10%	1.0	.0	
POMU	western sword-fern	20%	3.0	2.8	generally productive sites
PYAP	leafless pyrola	10%	1.0	.0	
PYPI	whitevein pyrola	10%	1.0	.0	
PYSE	one-sided pyrola	20%	1.0	.0	prefers thick duff layer
SADO	yerba buena	10%	2.0	0	moderate to dry site indicator
SMRA	western false Solomon's-seal	50%	1.0	.0	
SMST	starry false Solomon's-seal	80%	3.6	2.7	
SYRE	snow-queen	50%	1.6	.9	
TRLA2	western starflower	100%	2.6	1.6	
TROV	white trillium	90%	1.8	7	moist sites, mid successional
VAHE	white inside-out-flr	70%	2.9	1.7	
VECA	Calif. false hellebore	10%	1.0	0	
VIAM	American vetch	30%	2.3	1.5	
VIAD	early blue violet	10%	1.0	0	
VIGL	stream violet	30%	2.0	1.0	
VIOR2	round-leaved violet	10%	2.0	0	
	TOTAL HERB	100%	41.2	27.4	
BRPA	Pacific brome	30%	1.0	0	
FEOC	western fescue	60%	1.2	.4	
MESU	Alaska oniongrass	30%	1.0	.0	
	TOTAL GRASS	100%	1.3	1.2	

**WHITE FIR / WESTERN SERVICEBERRY / THREELEAF ANEMONE**  
*Abies concolor* / *Amelanchier alnifolia* / *Anemone deltoidea*  
**ABCO/AMAL/ANDE**

**EXTENT:** ABCO/AMAL/ANDE occurs on the Ashland and Butte Falls Ranger Districts, Rogue River National Forest. N = 10 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/AMAL/ANDE can be distinguished by the presence of western serviceberry, Oregon boxwood, and golden chinquapin. It is in the moderate temperature and low precipitation corner of the environmental grid, so indicators of temperature or moisture extremes such as snow bramble, thin-leaved huckleberry, California black oak, Piper's Oregongrape, salal, Pacific rhododendron, vine maple, and vanillaleaf are absent.

**ABIOTIC ENVIRONMENT:** ABCO/AMAL/ANDE is found between 3600 and 4900 feet on the middle to upper third of westerly slopes. Slopes are gentle and moderately dissected with approximately 1.8 intermittent or larger streams per mile. Parent materials are andesite and basalt, and soils are deeper than average for the Series, both in rooting and total soil depth. Total basal area is above average for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4358.0	390.0
Aspect (deg)	285.5	73.7
Slope (%)	18.6	20.8
Total soil depth (in)	44.36	7.8
Rooting depth (in)	48.36	3.8
Total basal area (ft <sup>2</sup> /ac)	328.0	98.1

**CLIMATE:** Relative to the Series and to the Cascade Province, ABCO/AMAL/ANDE is located at the cool/moderate, dry end of the environmental grid. Temperatures are slightly below average for the Series, as is precipitation. Mean annual precipitation is 6.5 inches less than the Series average and dry season precipitation is 0.6 inches less. Biomass production is limited by moisture late in the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.8	1.0
Maximum month temp (F)	77.2	1.6
Mean annual ppt (in)	47.0	4.8
Dry season ppt (in)	6.9	.6

**FOREST FLOOR:** Litter is slightly greater than the Series average of 93 percent and moss cover is much less than average, due to the cool to moderate temperatures.

FOREST FLOOR	MEAN	S.D.
Litter (%)	95.0	4.8
Moss (%)	4.5	4.7
Bareground (%)	.9	1.9
Gravel (%)	.5	.7
Rock (%)	6.4	6.1
Bedrock (%)	.2	.6

**VEGETATION:** Douglas-fir and white fir dominate the overstory with ponderosa pine common. Shasta red fir and western white pine are found on the cooler sites. The overstory cover is the highest of the White Fir Series, while the understory cover is the lowest. The understory is predominantly white fir, with golden chinquapin and Douglas-fir common. Engelmann spruce is found in wet areas and Pacific yew in areas of high humidity. Western white pine is found on the colder sites and golden chinquapin on shallow, rocky sites. White fir, Douglas-fir, incense-cedar, and western white pine will invade the site following disturbance. All are well suited for seeding on mineral soil. Western white pine is best adapted on frosty microsites.

Western serviceberry, dwarf Oregongrape, common prince's-pine, Oregon boxwood, baldhip rose, Pacific blackberry, and creeping snowberry are common shrubs. Oregon boxwood is an indicator of cooler sites. Pathfinder, threeleaf anemone, white-flowered hawkweed, mountain sweet-root, western starflower, and white inside-out-flower are common herbs of both the Association and the Cascades.

**SILVICULTURE:** Douglas-fir, white fir, incense-cedar, western hemlock, Engelmann spruce, and western white pine are all appropriate for regeneration. Engelmann spruce is suited to wet areas and western hemlock to areas within its natural range north of the middle of the Butte Falls Ranger District. Western white pine is adapted for cold, frosty microsites, however, *Ribes* species may be present in the stands so blister rust is a consideration. For diversity, Pacific yew would do well in areas of high humidity and golden chinquapin on the rockier spots. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO/AMAL/ANDE is above the Series average of 290 square feet.

Total shrub cover ranges from 22 to 136 percent with an average 66 percent, which is above average for the Series. Most of the cover is from dwarf Oregon-grape, common prince's-pine, and California hazel. California hazel, Pacific dogwood, and Douglas maple provide competition to seedlings for moisture. Herb cover ranges from 24 to 112 percent with an average of 64.1, which is above the Series average. In those areas with heavy herb cover, resource competition may be detrimental to seedling growth and survival.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 55 inches with an average of 47.0 inches. The majority occurs as rain from fall through spring with only 6 to 8 inches falling during the dry season (May through September).

The majority of sample plots were found on andesites and basalts, from 3600 to 4800 feet, and on slopes from 2 to 38 percent (with one plot on 70 percent slope). These soils are well drained and have moderate infiltration rates. The soils are rated as very stable with no expected mass movement as a result of management activities. The soil erosion potential is slight but compaction may lessen sur-

vival and growth. (See the Rogue River National Forest SRI for site specific information.) Shrub and herb cover are above average for the Series. Revegetation following disturbance would be moderately rapid. ABCO/AMAL/ANDE is generally found on the upper and middle third of convex slopes and away from riparian areas or wetlands.

**FIRE MANAGEMENT:** Evidence of fire was found on 6 of the 10 plots. Stand age ranges from 133 to 270 years with ages of 180 to 185 years on three of the plots. Westerly aspects combined with less than average precipitation would result in a moderately rapid drying of the fuels. Underburns would occur as well as the occasional intense, stand regenerating fire. White fir, Douglas-fir, incense-cedar, and golden chinquapin regeneration provide a fuel ladder to the overstory.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with little cover of palatable browse and moderate cover of herbage. Browse species such as Pacific dogwood, California hazel, creambush ocean-spray, thimbleberry, and Pacific blackberry are scattered throughout the stands. Water is available from 18 intermittent or larger streams per mile.

Stands mostly have a closed canopy and provide thermal cover. There is little hiding cover, other than in the younger stands or in openings with brush or advanced regeneration. Down woody material is scattered throughout the stands.

**RECREATION & VISUAL MANAGEMENT:** From a visual and recreation standpoint, this Association is typical of the Cascades. It is found on gentle slopes and away from areas of recreational interest such as stream bottoms and ridgetops. There are no outstanding features and the potential for berry picking is low. Pacific dogwood and Douglas maple provide color in the spring and fall.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	90%	35.8	14.2	indicates cold, moderate conditions fire resistant somewhat tolerant of drought cold sites previous fire history
ABMAS	Shasta red fir	10%	1.0	.0	
CADE3	incense-cedar	10%	2.0	.0	
PILA	sugar pine	10%	5.0	.0	
PIMO	western white pine	20%	7.5	3.5	
PIPO	ponderosa pine	50%	8.6	4.4	
PSME	Douglas-fir	100%	34.0	21.7	
	TOTAL OVERSTORY	100%	72.8	10.3	
ABCO	—CONIFERS—				climax increases diversity good in wet areas susceptible to blister rust found in pockets of high humidity northerly end of Butte Falls RD
ABCO	white fir	100%	27.5	8.9	
CADE3	incense-cedar	60%	5.2	3.8	
PIEN	Engelmann spruce	20%	1.5	.7	
PIMO	western white pine	10%	2.0	.0	
PSME	Douglas-fir	80%	10.5	9.8	
TABR	Pacific yew	20%	3.5	2.1	
TSHE	western hemlock	30%	2.3	2.3	
	—HARDWOODS—				
ACGL	Douglas maple	20%	3.5	3.5	
CACH	golden chinquapin	100%	6.5	5.3	
	TOTAL UNDERSTORY	100%	48.1	20.1	
AMAL	western serviceberry	100%	5.3	7.1	deep, fertile soils early successional, indicates recent fire history mid to late successional moist conditions, cool sites, generally well-drained soils alternate host for blister rust
BENE	dwarf Oregongrape	100%	18.0	20.1	
CEVE	snowbrush	10%	1.0	.0	
CHME	little prince's-pine	30%	1.3	.6	
CHUM	common prince's-pine	90%	13.6	16.8	
CONU	Pacific dogwood	30%	12.7	12.0	
COCOC	California hazel	70%	11.1	11.2	
HODI	creambush ocean-spray	10%	2.0	.0	
LOCI	trumpet honeysuckle	10%	2.0	.0	
PAMY	Oregon boxwood	100%	2.1	1.0	
RIBES	currant spp.	20%	1.0	.0	
RILO	gummy gooseberry	20%	1.0	.0	
RIVI	sticky currant	10%	1.0	.0	
ROGY	baldhip rose	100%	4.7	3.4	
RUPA	thimbleberry	20%	1.5	.7	
RUUR	Pacific blackberry	90%	4.7	3.7	
SYMO	creeping snowberry	90%	6.2	9.1	
WHMO	whipplevine	10%	8.0	.0	
	TOTAL SHRUB	100%	66.2	36.9	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ADBI	trail-plant, pathfinder	90%	4.0	2.1	wet, cool sites
ANDE	threeleaf anemone	100%	4.0	2.9	
ANLY2	Lyll anemone	10%	1.0	.0	
ARMA3	bigleaf sandwort	50%	1.8	1.1	
ASCA3	western wild ginger	30%	1.7	.6	
CABU2	fairy-slipper	10%	1.0	0	
CASC2	rough harebell	40%	2.5	3.0	
CLUN	queen's cup	40%	3.0	2.4	
COMA3	spotted coral-root	20%	1.0	.0	
COME	Pacific coral-root	20%	1.0	.0	
COST2	hooded coral-root	20%	1.0	.0	mid to late successional berries are tasty
DIFO	Pacific bleedingheart	10%	1.0	.0	
DIHOO	Oregon fairybell	70%	1.4	.8	
FRVEB	woods strawberry	50%	3.2	2.9	
GAAP	catchweed bedstraw	70%	1.6	1.0	
GOOB	rattlesnake-plantain	60%	1.2	.4	
HABEN		10%	1.0	.0	
HACA	large-fl'd goldenweed	10%	1.0	.0	
HAL	white-flowered hawkweed	80%	1.5	.8	
LIBOL	western twinflower	70%	40.7	30.1	
LICA3	northwest listera	20%	1.0	0	cool, moist forests, late successional
MITR2	three-tooth mitrewort	10%	1.0	.0	
MOSI	candyflower	10%	5.0	.0	
NEHE	small white nemophila	20%	1.5	.7	
OSCH	mountain sweet-root	90%	2.0	1.3	
PERA	leafy lousewort	20%	2.0	1.4	
PTAQ	bracken	10%	1.0	.0	
PYPI	whitevein pyrola	30%	1.0	0	
PYSE	one-sided pyrola	50%	1.0	.0	
SMST	starry false Solomon's-seal	60%	4.3	2.3	
SYRE	snow-queen	60%	2.8	1.9	
TRLA2	western starflower	90%	3.3	2.3	
TROV	white trillium	30%	1.0	.0	
VAHE	white inside-out-flr	90%	5.0	6.3	
VECA	Calif. false hellebore	30%	1.0	0	
VIGL	stream violet	40%	1.3	.5	
VIOR2	round-leaved violet	20%	2.5	.7	
	TOTAL HERB	100%	64.1	32.4	
BRPA	Pacific brome	40%	2.0	1.2	
CAREX	sedge spp.	10%	1.0	0	
FESTU	fescue spp.	10%	1.0	0	
FEOC	western fescue	60%	1.7	1.6	
MESU	Alaska oniongrass	20%	1.5	.7	
	TOTAL GRASS	100%	2.5	1.9	

**WHITE FIR / DWARF OREGONGRAPE / THREELEAF ANEMONE**  
*Abies concolor* / *Berberis nervosa* / *Anemone deltoidea*  
**ABCO/BENE/ANDE**

**EXTENT:** ABCO/BENE/ANDE occurs on the Ashland and Butte Falls Ranger Districts, Rogue River National Forest. N = 6 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/BENE/ANDE is at the cool, dry end of the environmental grid. It can be distinguished by the absence of many common Cascade species and those that indicate extremes of cold, hot, dry or wet. For example, salal, Pacific rhododendron, California black oak, Pacific yew, snow bramble, vine maple, Douglas maple, Piper's Oregongrape, incense-cedar, thin-leaved huckleberry, and Oregon boxwood are absent. Common prince's-pine may be present, but with less than 10 percent cover.

**ABIOTIC ENVIRONMENT:** ABCO/BENE/ANDE is found at the upper elevations of the Series, between 4400 and 5400 feet, on the middle to upper third of the slopes, with southeast or northwest aspects. Slopes are gentle and are minimally dissected. Parent material is andesite or basalt and the soils are deeper than average for the Series, both total soil and rooting depths. Total basal area is slightly below the Series average of 290 square feet.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4927.0	305.0
Aspect (deg)	136.3	81.3
Slope (%)	17.8	11.5
Total soil depth (in)	44.7	5.8
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	266.7	68.9

**CLIMATE:** Relative to the White Fir Series and to the Cascade Province, ABCO/BENE/ANDE is at the cool, dry end of the environmental grid. Temperatures are the lowest of the White Fir Series, both mean annual and maximum monthly measurements. Precipitation is also low for the Series, with the mean annual precipitation 7 inches less than average and the dry season precipitation 1 inch less. Low soil and air temperatures, combined with moisture limitation late in the growing season, limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	42.4	.7
Maximum month temp (F)	74.9	1.2
Mean annual ppt (in)	46.7	5.2
Dry season ppt (in)	6.7	.5

**FOREST FLOOR:** Litter is slightly greater than the Series average of 93 percent and the moss cover is the lowest of the Series. Cool temperatures limit the growth of moss as well as the decomposition of the litter.

FOREST FLOOR	MEAN	S.D.
Litter (%)	95.8	3.3
Moss (%)	2.2	1.8
Bareground (%)	.2	.4
Gravel (%)	.3	.5
Rock (%)	4.7	4.5
Bedrock (%)	.0	.0

**VEGETATION:** White fir and Douglas-fir dominate the overstory, with an occasional ponderosa pine if there is a recent history of fire (200 to 300 years). The understory is predominantly white fir with occasional Douglas-fir, western white pine, golden chinquapin, and ponderosa pine. The western white pine is found on the cold, frosty microsites and the ponderosa pine on the warmer, drier sites. White fir, Douglas-fir, western white pine, and ponderosa pine will invade after a disturbance. All are well suited to seeding on mineral soil, however, on frosty sites, Douglas-fir will not survive and grow as well as western white pine or ponderosa pine.

This Association has the lowest total shrub cover of the White Fir Series (20.5 percent). Common shrubs include dwarf Oregongrape, western serviceberry, common prince's-pine, baldhip rose, and creeping snowberry. Total herb cover is also low at 26.2 percent. Common herbs include threeleaf anemone, bigleaf sandwort, and starry false Solomon's-seal.

**SILVICULTURE:** White fir, Douglas-fir, western white pine, and ponderosa pine are appropriate for

regeneration. Western white pine would be suitable for frosty microsites and ponderosa pine on the disturbed, warmer, drier sites or where site prep was fire. For diversity, golden chinquapin would do well in areas of shallow, rocky soils. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. Douglas-fir and white fir are the most productive species on the sites. The total basal area for **ABCO/BENE/ANDE** is below average for the White Fir Series.

Total shrub cover ranges from 3 to 33 percent with an average of 20.5 percent, which is the lowest of the White Fir Associations. Total shrub cover is limited by the cool temperatures. The hardwood cover is also very low. The species that are present, western serviceberry, California hazel, creambush ocean-spray, common snowberry, and creeping snowberry, can all provide competition to seedlings. Herb cover is also the lowest of the White Fir series as it ranges from 9 to 48 percent with an average of 26.2 percent.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 50 inches with an average of 46.7 inches. The majority falls as rain from fall through spring with only 6 to 7 inches falling during the dry season (May through September).

All of sample plots were found on andesites and basalts from 4500 to 5400 feet on slopes from 3 to 37 percent. These soils are well drained with moderate infiltration rates. They are very stable with no expected mass movement as a result of management activities. The soil erosion potential is slight, but compaction may lessen survival and growth. (See Rogue River National Forest SRI for site specific information.)

Shrub and herb cover are the lowest of the White Fir Series. Revegetation following disturbance would be slow with the low temperatures. To revegetate, draw from the species listed for this Association. Pioneer species would be best adapted to conditions requiring revegetation. **ABCO/BENE/ANDE** is generally found on the upper and middle third of slopes and not in riparian areas or wetlands.

**FIRE MANAGEMENT:** Evidence of fire was found on 3 of the 6 plots. Stand ages ranged from 60 to 100 years with a disturbance age on two plots of 65 to 80 years. The cold, dry conditions would slow the decomposition of litter and fuels. Underburns could occur during dry years as well as the occasional, intense stand regenerating fires.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited with sparse cover of palatable shrubs and herbage. Browse species such as California hazel, creambush ocean-spray, and Pacific blackberry are only occasionally found. Grass cover is low (2.3 percent). Water is also infrequently available. The environment is too cold for winter range.

The young stands of this Association are thick and provide good thermal cover with only small diameter down, woody material. The older stands have patches of regeneration that provide good hiding cover. Down, woody material in these stands is larger and more scattered than in the younger stands.

**RECREATION & VISUAL MANAGEMENT:** From a recreational and visual standpoint, this Association is typical of the Cascades. It is generally found on the slopes and away from areas of recreational interest such as stream bottoms or ridgetops. There are no outstanding features and the potential for berry picking is low.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	83%	36.0	21.0	evidence of fire history
PIPO	ponderosa pine	16%	5.0	.0	
PSME	Douglas-fir	83%	38.0	32.9	
	TOTAL OVERSTORY	100%	62.5	21.6	
ABCO	—CONIFERS—				minor component of later seral stages seral species, evidence of warmer, drier conditions
	white fir	100%	65.8	25.4	
PIMO	western white pine	16%	1.0	.0	
PIPO	ponderosa pine	16%	2.0	.0	
PSME	Douglas-fir	33%	3.5	2.1	shallow, rocky soils
	—HARDWOODS—				
CACH	golden chinquapin	16%	2.0	.0	
	TOTAL UNDERSTORY	100%	67.8	24.1	
AMAL	western serviceberry	66%	1.8	1.0	deep, fertile soils
BENE	dwarf Oregongrape	83%	4.8	3.3	
CHME	little prince's-pine	50%	1.7	.6	
CHUM	common prince's-pine	66%	3.8	1.5	
COCOC	California hazel	16%	2.0	.0	hot, dry conditions alternate host for blister rust moderate - high elevations, widespread
HODI	creambush ocean-spray	33%	3.0	1.4	
LONIC	honeysuckle spp.	16%	1.0	.0	
RIBES	currant spp.	33%	2.0	1.4	
RILO	gummy gooseberry	33%	1.0	.0	
RIVI	sticky currant	16%	8.0	.0	
ROGY	baldhip rose	66%	3.8	2.2	
RUUR	Pacific blackberry	50%	4.7	6.4	
SYAL	common snowberry	16%	6.0	.0	
SYMO	creeping snowberry	66%	2.0	1.4	
WHMO	whipplevine	16%	5.0	.0	
	TOTAL SHRUB	100%	20.5	12.9	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	16%	2.0	.0	<p>fixes nitrogen</p> <p>generally cool sites, mid to late successional</p> <p>warm, moist sites, low elevations</p>
ADBI	trail-plant, pathfinder	50%	2.0	.0	
ANDE	threeleaf anemone	83%	3.0	1.9	
ANLY2	Lyal anemone	33%	1.0	.0	
ARMA3	bigleaf sandwort	83%	2.0	1.7	
ASCA3	western wild ginger	33%	1.0	.0	
CABU2	fairy-slipper	50%	1.0	.0	
CASC2	rough harebell	50%	1.7	.6	
CLUN	queen's cup	16%	1.0	.0	
COHE	varied-leaved collomia	16%	1.0	.0	
COMA3	spotted coral-root	33%	1.0	.0	
COST2	hooded coral-root	16%	1.0	0	
CYGR	Pacific hound's-tongue	16%	1.0	.0	
DIFO	Pacific bleedingheart	16%	1.0	.0	
FRVEB	woods strawberry	66%	2.0	1.2	
GAAP	catchweed bedstraw	66%	1.0	.0	
GOOB	rattlesnake-plantain	66%	1.0	.0	
HAL	white-flowered hawkweed	16%	3.0	.0	
LAP0	leafy peavine	33%	3.5	2.1	
LIBOL	western twinflower	16%	5.0	.0	
LUCA2	tailcup lupine	16%	1.0	.0	
MITR2	three-tooth mitrewort	16%	1.0	.0	
MOSI	candyflower	33%	1.0	.0	
MOSIS	candyflower	16%	2.0	.0	
NEHE	small white nemophila	33%	1.0	.0	
OSCH	mountain sweet-root	50%	1.7	.6	
PERA	leafy lousewort	16%	1.0	.0	
PYAP	leafless pyrola	16%	1.0	.0	
PYPI	whitevein pyrola	33%	1.5	.7	
SMST	starry false Solomon's-seal	83%	3.0	2.0	
SYRE	snow-queen	33%	1.0	.0	
TRLA2	western starflower	66%	1.8	1.0	
TROV	white trillium	66%	1.5	.6	
VAHE	white inside-out-flr	66%	3.5	2.4	
VIAM	American vetch	33%	2.0	1.4	
VIGL	stream violet	50%	1.7	.6	
VIOR2	round-leaved violet	16%	2.0	0	
	TOTAL HERB	100%	26.2	15.6	
BRPA	Pacific brome	16%	2.0	.0	
CYEC	hedgehog dogtail	16%	1.0	.0	
FEOC	western fescue	33%	2.0	1.4	
MESU	Alaska oniongrass	50%	1.7	1.2	
	TOTAL GRASS	100%	2.3	2.9	

**WHITE FIR / COMMON PRINCE'S-PINE / PYROLA**  
*Abies concolor* / *Chimaphila umbellata* / *Pyrola*  
**ABCO/CHUM/PYROLA**

**EXTENT:** ABCO/CHUM/PYROLA occurs on the Prospect Ranger District, Rogue River National Forest and Diamond Lake Ranger District, Umpqua National Forest. N = 6 plots.

**IDENTIFYING CHARACTERISTICS:** ABCO/CHUM/PYROLA can be distinguished from other White Fir Associations by the absence of many common Cascade species and those that indicate extremes of cold, hot, dry or wet. For example, salal, Pacific rhododendron, California black oak, Pacific yew, snow bramble, vine maple, Douglas maple, western serviceberry, Piper's Oregongrape, and incense-cedar are absent. Common prince's-pine is present with greater than 10 percent cover.

**ABIOTIC ENVIRONMENT:** ABCO/CHUM/PYROLA is found at elevations ranging from 3800 feet to 4900 feet from the ridgetop to the lower third of the slope. Aspects are southerly, and slopes are gentle and moderately dissected with 1.9 intermittent or greater streams per mile. Parent material is either andesite or pumice with total soils depth shallower than the Series average, and rooting depth slightly deeper than the Series average. Total basal area is less than average for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	4543.0	380.0
Aspect (deg)	175.0	64.3
Slope (%)	22.8	19.5
Total soil depth (in)	37.5	16.7
Rooting depth (in)	47.1	4.6
Total basal area (ft <sup>2</sup> /ac)	270.0	43.4

**CLIMATE:** Relative to the White Fir Series and the Cascade Province, ABCO/CHUM/PYROLA is at the cool, moderate precipitation end of the environmental grid. Temperatures are slightly less than average for the White Fir Series, both mean annual and maximum monthly measurements. Mean annual precipitation is 9 inches greater than the Series average and the dry season precipitation is 0.5 inches greater. Moisture limitation late in the growing season limits biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	43.5	1.1
Maximum month temp (F)	76.5	1.5
Mean annual ppt (in)	62.5	6.9
Dry season ppt (in)	8.0	.6

**FOREST FLOOR:** Litter is slightly greater than the Series average of 93 percent and the moss cover is the lowest of the Series. Cool temperatures limit the growth of moss as well as decomposition on the soil interface.

FOREST FLOOR	MEAN	S.D.
Litter (%)	95.3	4.1
Moss (%)	1.7	1.4
Bareground (%)	1.3	1.9
Gravel (%)	.7	.5
Rock (%)	2.0	2.8
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir or white fir dominates the overstory with ponderosa pine common and Shasta red fir, knobcone pine, sugar pine, and western white pine rare. Ponderosa pine and knobcone pine in the overstory indicate recent fire history. Ponderosa pine came in as the stand regenerated 200 to 300 years ago. Knobcone pine came in during regeneration, however, its life span generally is 90 to 120 years, thus indicating a more recent fire. This Association has one of the highest total overstory covers (70.8 percent) of the White Fir Series. White fir dominates the understory, with golden chinquapin usually present, and Douglas-fir and western hemlock common. Western white pine is rare in the understory and found on the cold, frosty microsites. White fir, Douglas-fir, western hemlock, and western white pine will invade after a disturbance as all are well suited to seeding on mineral soil. Golden chinquapin will sprout following disturbance.

In the shrub layer common prince's-pine is usually present and abundant, with dwarf Oregongrape, Pacific blackberry, and Oregon boxwood common.

Total herb cover is one of the lowest (22.3 percent) of the White Fir Series. Threelobed anemone, one-sided pyrola, white-flowered hawkweed, and bracken fern are common.

**SILVICULTURE:** White fir, Douglas-fir, western hemlock, and western white pine are appropriate for regeneration. Western white pine would be suitable on cold, frosty sites. For diversity, golden chinquapin will sprout well in areas of shallow, rocky soils. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. Douglas-fir and white fir are the most productive species on the sites. The total basal area for **ABCO/CHUM/PYROLA** is below average for the White Fir Series.

Total shrub cover ranges from 34 to 58 percent with an average of 44.3 percent, which is below the Series average. However, the cover of golden chinquapin ranges from 2 to 40 percent with an average of 12 percent. On the shallow, rocky soils it will compete with seedlings for moisture. The major shrub, common prince's-pine, is not a serious competitor with conifer seedlings. Herb cover is also low, ranging from 7 to 36 percent with an average of 22.3 percent.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 50 to 70 inches with an average of 62.5 inches. Most occurs as rain from fall through spring with only 7 to 9 inches falling during the dry season (May through September). Sample plots were found on both andesite/basalt and pumice/ash, at elevations from 3800 to 4800 feet, and on slopes from 9 to 20 percent with one plot at 62 percent. Because of the difference in parent materials, it is inappropriate to generalize soil characteristics. See the Umpqua National Forest SRI for site specifics.

Herb cover is the lowest in the White Fir Series and shrub cover is below average. Revegetation follow-

ing disturbance would be moderate with the cool temperatures and moderate precipitation. To revegetate, draw from the pioneers in the species list for this Association; they are adapted to local conditions. **ABCO/CHUM/PYROLA** is found from the ridgetops to the lower third of the slopes and is not found in riparian areas or in wetlands.

**FIRE MANAGEMENT:** Evidence of fire was found on 3 of the 6 plots. Stand ages ranged from 60 to 195 and the stand age on the plot with knobcone pine was 95 years. Decomposition rates of litter and fuels would be normal in the cool, moist environments on the southerly aspects. Underburns could occur during the dry years as well as the occasional, intense stand regenerating fire every 100 to 200 years.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited with sparse cover of palatable shrubs and herbage. Browse species such as Pacific dogwood, California hazel, dwarf bramble, thimbleberry, and Pacific blackberry are only occasionally found. Grass cover is low (0.7 percent). Water is moderately available with 1.9 intermittent or greater streams per mile.

The young stands of the Association are thick and provide good thermal cover with only small diameter down, woody material. The older stands have patches of regeneration that provide good hiding cover. Down, woody material in these stands is larger and more scattered than in the younger stands.

**RECREATION & VISUAL MANAGEMENT:** From a recreation and visual standpoint, this Association is typical of the Cascades. It is generally found on the slopes and away from areas of recreational interest such as stream bottoms or ridgetops. There are no outstanding features and the potential for berry picking is low.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	66%	42.0	16.0	cold, moderate conditions evidence of fire within the last 100 years somewhat drought tolerant cold conditions evidence of recent fire
ABMAS	Shasta red fir	16%	5.0	.0	
PIAT	knobcone pine	16%	10.0	.0	
PILA	sugar pine	16%	15.0	.0	
PIMO	western white pine	33%	6.5	2.1	
PIPO	ponderosa pine	50%	5.7	1.2	
PSME	Douglas-fir	100%	32.8	20.5	
	TOTAL OVERSTORY	100%	70.8	15.9	
ABCO	—CONIFERS— white fir	100%	28.3	17.2	suited to frost prone areas warmer, drier conditions warmer, wetter conditions
PIMO	western white pine	16%	1.0	.0	
PSME	Douglas-fir	83%	16.6	9.8	
TSHE	western hemlock	50%	5.3	2.5	
	—HARDWOODS—				
CACH	golden chinquapin	100%	12.2	14.6	shallow, rocky soils
	TOTAL UNDERSTORY	100%	57.2	14.5	
BENE	dwarf Oregongrape	83%	5.8	5.4	deep, fertile soils mid to late successional     cool to cold, moist sites
CHUM	common prince's-pine	100%	27.5	6.1	
CONU	Pacific dogwood	16%	5.0	.0	
COCOC	California hazel	16%	3.0	.0	
PAMY	Oregon boxwood	50%	1.0	.0	
ROGY	baldhip rose	33%	1.0	0	
RULA	dwarf bramble	16%	15.0	.0	
RUPA	thimbleberry	16%	12.0	.0	
RUUR	Pacific blackberry	83%	5.2	2.3	
SYMO	creeping snowberry	33%	1.5	.7	
VAME	thin-leaved huckleberry	16%	1.0	.0	
VASC	grouse huckleberry	16%	2.0	0	
	TOTAL SHRUB	100%	44.3	8.4	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	50%	6.0	5.3	
ADBI	trail-plant, pathfinder	16%	4.0	.0	
ANDE	threelobed anemone	83%	1.4	.5	
ANLY2	Lyall anemone	16%	1.0	.0	
APAN	spreading dogbane	50%	1.3	.6	
AQFO	Sitka columbine	16%	1.0	.0	
ARMA3	bigleaf sandwort	33%	2.5	.7	
CABU2	fairy-slipper	16%	1.0	.0	
CASC2	rough harebell	16%	2.0	.0	
COHE	varied-leaved collomia	16%	1.0	.0	
COMA3	spotted coral-root	16%	1.0	.0	
COME	Pacific coral-root	33%	1.0	.0	
COST2	hooded coral-root	16%	1.0	.0	
EBAU	phantom-orchid	16%	1.0	.0	
FRVEB	woods strawberry	50%	1.3	.6	
GAAP	catchweed bedstraw	50%	1.3	.6	
GATR	fragrant bedstraw	16%	1.0	0	
GOOB	rattlesnake-plantain	33%	1.0	.0	
HAL	white-flowered hawkweed	66%	1.3	.5	
IRIS	iris spp.	16%	1.0	.0	
LIBOL	western twinflower	33%	5.0	2.8	
LICA3	northwest listera	33%	1.0	.0	
MITR2	three-tooth mitrewort	16%	3.0	.0	
MOSI	candyflower	16%	1.0	.0	
OSCH	mountain sweet-root	50%	1.0	.0	
PERA	leafy lousewort	33%	1.0	.0	
PESP	royal penstemon	16%	1.0	.0	
PTAQ	bracken	66%	2.8	1.7	
PYAP	leafless pyrola	16%	1.0	.0	
PYPI	whitevein pyrola	33%	1.5	.7	
PYSE	one-sided pyrola	83%	2.6	2.6	
SMST	starry false Solomon's-seal	16%	2.0	.0	
SYRE	snow-queen	16%	2.0	.0	
TRLA2	western starflower	50%	1.7	.6	
TROV	white trillium	50%	1.7	1.2	
VAHE	white inside-out-flr	33%	1.0	0	
VIGL	stream violet	16%	1.0	.0	
VIOR2	round-leaved violet	16%	1.0	.0	
	TOTAL HERB	100%	22.3	12.5	
BRVU	Columbia brome	16%	1.0	0	
MESU	Alaska oniongrass	33%	1.0	0	
	TOTAL GRASS	100%	.7	8	

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**WHITE FIR / CALIFORNIA HAZEL - WESTERN SERVICEBERRY**  
*Abies concolor* / *Corylus cornuta californica* / *Amelanchier alnifolia*  
**ABCO/COCOC-AMAL**

**EXTENT:** ABCO/COCOC-AMAL occurs on the Butte Falls Ranger District, Rogue River National Forest. N = 6 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of California black oak in the understory distinguishes ABCO/COCOC-AMAL from the other White Fir Associations.

**ABIOTIC ENVIRONMENT:** ABCO/COCOC-AMAL is located at the lower elevations of the White Fir Series, ranging from 3100 feet to 4000 feet. It is found on the middle third of the slopes or in the canyon bottoms, on moderate slopes with southwestern to northern aspects. Slopes are flat to gentle, and the landscape is not highly dissected, with only 1.1 intermittent or greater streams per mile. The parent material is andesite or basalt and the soils are deeper than average for the Series, both total soil and rooting depths. Total basal area is below the Series average of 290 square feet.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3510.0	328.0
Aspect (deg)	281.3	62.0
Slope (%)	13.3	17.4
Total soil depth (in)	42.7	8.3
Rooting depth (in)	48.2	4.3
Total basal area (ft <sup>2</sup> /ac)	256.7	67.4

**CLIMATE:** Relative to the White Fir Series and the Cascade Province, ABCO/COCOC-AMAL is at the dry, moderate temperature end of the environmental grid. Temperatures are above average for the Series, both mean annual and maximum monthly measurements. Precipitation is also low for the Series, with mean annual precipitation 8.5 inches less than average and the dry season precipitation 1.2 inches less, the lowest of the Series. Moisture limitation late in the growing season is the most limiting factor to biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.1	.9
Maximum month temp (F)	80.6	1.3
Mean annual ppt (in)	45.0	3.2
Dry season ppt (in)	6.3	.5

**FOREST FLOOR:** Litter cover is average for the Series and the moss cover is greater than average, indicating the warmer temperatures of the Association.

FOREST FLOOR	MEAN	S.D.
Litter (%)	93.7	7.1
Moss (%)	12.0	23.6
Bareground (%)	1.2	2.0
Gravel (%)	.3	.5
Rock (%)	4.2	5.6
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir dominates the overstory and white fir and ponderosa pine are common. White fir dominates the understory with Douglas-fir common. Incense-cedar, ponderosa pine, and sugar pine are occasional in the understory. California black oak is usually present in the understory and Douglas maple, Pacific madrone, and golden chinquapin are occasional. The ponderosa pine and Pacific madrone indicates recent fire history and the golden chinquapin indicates the shallow, rocky soils. White fir, Douglas-fir, ponderosa pine, sugar pine, and incense-cedar will invade after a disturbance as all are well suited to seeding on mineral soil.

Total shrub cover is one of the highest (84.2 percent) of the White Fir Series. Common shrubs include western serviceberry, Piper's Oregongrape, California hazel, cream-flush ocean-spray, baldhip rose, Pacific blackberry, and creeping snowberry. Total herb cover is below the Series average of 47 percent. Common herbs include threelobe anemone, bigleaf sandwort, catchweed bedstraw, mountain sweet-root, and western starflower.

**SILVICULTURE:** - White fir, Douglas-fir, ponderosa pine, sugar pine, and incense-cedar are all appropriate for regeneration. The advanced regeneration of white fir would be suitable for inclusion in the next stand if it can be protected from logging damage. White fir is susceptible to *Armillaria* root rot and *Annosus* root rot infection through wounds. For diversity, Pacific madrone, golden chinquapin, and California black oak would be appropriate for planting. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO/COCOC-AMAL is below average for the White Fir Series.

Total shrub cover ranges from 28 to 136 percent with an average of 84.2, one of the highest of the White Fir Series. The majority of the species include western serviceberry, Pacific dogwood, California hazel, and creambush ocean-spray, and all compete with seedlings. The hardwood understory component of Douglas maple, Pacific madrone, golden chinquapin, and California black oak also competes with seedlings for moisture. Herb cover is below average for the Series, ranging from 19 to 63 percent, with an average of 30 percent.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 50 inches with the majority occurring as rain from fall through spring, and only 6 to 7 inches falling during the dry season (May through September), the lowest for the Series.

All the sample plots are on andesites and basalts from 3100 to 4000 feet and on slopes from 0 to 10 percent with one plot at 48 percent. Soils are well drained with moderate infiltration rates. They are very stable and there is no expected mass movement as a result of management activities. The soil erosion potential is slight but compaction may less-

en survival and growth. (See Rogue River National Forest SRI for site specific information.)

Shrub cover is one of the highest of the White Fir Series, but the herb cover is below average. Revegetation following disturbance should be moderate to high. ABCO/COCOC-AMAL is found on canyon bottoms or on the middle third of the slopes, but usually not in riparian areas or wetlands.

**FIRE MANAGEMENT:** Evidence of fire was found on 5 of the 6 sample plots. Stand ages were 75 to 120 years. Fire is moderately frequent in this Association with its location at the lower elevations, higher than average temperatures, and lower than average precipitation. Intense, stand regenerating fires occur approximately every 60 to 150 years, however, less intense underburns are more frequent. The presence of ponderosa pine and madrone indicates relatively recent fires.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is moderate with moderate cover of shrubs and low cover of herbage. Browse species such as Pacific dogwood, California hazel, creambush ocean-spray, thimble-berry, and Pacific blackberry are prevalent throughout the stand. Grass cover is low (2.0 percent). Water is infrequently available with 1.1 intermittent or larger streams per mile.

Stands are brushy and provide good hiding cover. Down woody material is scattered through the stands.

**RECREATION & VISUAL MANAGEMENT:** ABCO/COCOC-AMAL is at the drier end of the White Fir Series and is found in the canyon bottoms and on the slopes. Brushy stand conditions limit the potential for cross country hiking.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	35.0	21.8	fire resistant somewhat drought tolerant warm, dry conditions and previous fire history
CADE3	incense-cedar	16%	5.0	.0	
PILA	sugar pine	50%	3.3	1.2	
PIPO	ponderosa pine	50%	34.7	40.1	
PSME	Douglas-fir	100%	20.5	16.8	
	TOTAL OVERSTORY	100%	57.8	24.7	
ABCO	—CONIFERS— white fir	100%	27.0	12.8	species diversity intermediate in light tolerance warm, dry conditions
CADE3	incense-cedar	50%	4.0	1.7	
PILA	sugar pine	16%	5.0	.0	
PIPO	ponderosa pine	33%	19.0	15.6	
PSME	Douglas-fir	83%	16.8	11.2	
	—HARDWOODS— Douglas maple	33%	3.0	2.8	evidence of recent fire history shallow, rocky soils hot, dry conditions
ACGL	Pacific madrone	33%	8.5	9.2	
ARME	golden chinquapin	33%	7.0	4.2	
CACH	California black oak	100%	5.3	4.9	
QUKE	TOTAL UNDERSTORY	100%	61.7	5.2	
AMAL	western serviceberry	100%	25.5	41.4	deep, loamy soil drier, rockier, less productive sites than where BENE occurs
BENE	dwarf Oregongrape	50%	10.3	4.0	
BEPI	Piper's Oregongrape	83%	7.6	5.9	
CHUM	common prince's-pine	16%	1.0	.0	occurs at low elevations on warm sites in well-drained soils warm to dry sites, often rocky, shallow soils moist to wet site indicator
CONU	Pacific dogwood	66%	18.7	9.5	
COCOC	California hazel	83%	30.2	23.9	
HODI	creambush ocean-spray	83%	14.2	15.4	warm, dry slopes
RHPU	cascara	16%	8.0	.0	
ROGY	baldhip rose	83%	1.6	.9	
RUPA	thimbleberry	16%	5.0	.0	
RUUR	Pacific blackberry	100%	2.5	2.0	
SYAL	common snowberry	16%	5.0	0	
SYMO	creeping snowberry	100%	4.8	5.1	
WHMO	whipplevine	50%	3.0	0	
	TOTAL SHRUB	100%	84.2	39.3	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACMI	common yarrow	16%	1.0	.0	thrives in dry, disturbed areas
ADBI	trail-plant, pathfinder	50%	2.3	1.5	
ANDE	threeleaf anemone	83%	1.0	.0	
APAN	spreading dogbane	33%	1.0	.0	
ARMA3	bigleaf sandwort	83%	1.4	.9	
CASC2	rough harebell	50%	1.7	1.2	apricot colored flowers
CASTI		16%	1.0	.0	
COHE	varied-leaved collomia	16%	1.0	.0	
COMA3	spotted coral-root	33%	1.0	.0	
DIHOO	Oregon fairybell	50%	1.0	.0	
EBAU	phantom-orchid	16%	1.0	.0	tasty berries
FRVEB	woods strawberry	66%	6.5	5.7	
GAAP	catchweed bedstraw	83%	2.0	1.4	
GOOB	rattlesnake-plantain	50%	1.3	.6	
HAL	white-flowered hawkweed	50%	1.7	.6	
LWA	Washington lily	16%	1.0	0	fragrant flowers
LIBOL	western twinflower	16%	1.0	0	
LUCA2	tailcup lupine	16%	1.0	0	
LUPIN	lupine spp.	16%	2.0	.0	
OSCH	mountain sweet-root	83%	3.2	3.9	
PERA	leafy lousewort	16%	1.0	0	dry site indicator
POGL	sticky cinquefoil	16%	1.0	0	
PTAQ	bracken	16%	1.0	.0	
PYAP	leafless pyrola	16%	1.0	.0	
SADO	yerba buena	16%	3.0	0	
SIDAL		16%	1.0	.0	mid successional
SMRA	western false Solomon's-seal	16%	1.0	.0	
SMST	starry false Solomon's-seal	33%	3.0	1.4	
SYRE	snow-queen	50%	1.0	0	
TRLA2	western starflower	100%	5.0	5.0	
TROV	white trillium	16%	1.0	0	early successional
VAHE	white inside-out-flr	33%	5.0	.0	
VECA	Calif. false hellebore	16%	1.0	.0	
VIAM	American vetch	16%	3.0	.0	
VIGL	stream violet	50%	4.3	4.9	
	TOTAL HERB	100%	30.0	16.8	
BRPA	Pacific brome	33%	2.0	1.4	
ELYMU	wildrye spp.	16%	1.0	0	
FESTU	fescue spp.	16%	1.0	0	
FEOC	western fescue	66%	1.0	0	
MESU	Alaska oniongrass	16%	1.0	0	
	TOTAL GRASS	100%	2.0	.9	

**WHITE FIR / POISON OAK**  
*Abies concolor* / *Rhus diversiloba*  
**ABCO/RHDI**

**EXTENT:** ABCO/RHDI occurs on the North Umpqua and Tiller Ranger Districts, Umpqua National Forest. N = 3 plots.

**IDENTIFYING CHARACTERISTICS:** The combination of the presence of poison oak and the absence of Piper's Oregongrape distinguish ABCO/RHDI from the other White Fir Associations.

**ABIOTIC ENVIRONMENT:** ABCO/RHDI is found at the lowest elevations of the White Fir Series, ranging from 2100 feet to 2400 feet on the middle to upper third of the slopes on all aspects. Slopes are moderate, and moderately dissected with 3.2 intermittent streams per mile. Parent material is either andesite or tephra. Soil depth on tephra is deep, while on the andesite it is shallow. Moisture holding capacity of either soil usually is low, either due to coarseness on the tephra or the shallowness on andesite. Total basal area is low for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2253.0	122.0
Aspect (deg)	3.3	98.6
Slope (%)	34.3	14.0
Total soil depth (in)	38.6	19.8
Rooting depth (in)	39.3	18.6
Total basal area (ft <sup>2</sup> /ac)	236.7	115.0

**CLIMATE:** Relative to the White Fir Series and the Cascade Province, ABCO/RHDI is at the hot, moderate precipitation end of the environmental grid. Temperatures are the highest of the Series, both mean annual and maximum monthly. Precipitation, mean annual and dry season, is average for the Series. Moisture limitations late in the growing season limit biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	49.1	.5
Maximum month temp (F)	85.5	.5
Mean annual ppt (in)	53.3	10.4
Dry season ppt (in)	7.7	.6

**FOREST FLOOR:** Litter cover is lowest of the Series and moss cover is the highest, indicating a warm climate conducive to litter and fuel decomposition as well as moss growth.

FOREST FLOOR	MEAN	S.D.
Litter (%)	81.7	10.4
Moss (%)	60.0	10.0
Bareground (%)	1.3	.6
Gravel (%)	10.7	16.8
Rock (%)	7.3	6.8
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir dominates the overstory with sugar pine and incense-cedar usually present. In the understory, white fir dominates with Pacific yew, incense-cedar, ponderosa pine, Douglas-fir, western redcedar, and western hemlock occasionally present. Pacific madrone is usually present, with big-leaf maple and golden chinquapin occasionally present. Pacific yew and western redcedar are found in pockets of high humidity, and chinquapin on shallower, rocky soils. White fir, ponderosa pine, incense-cedar, sugar pine, and Douglas-fir will invade after a disturbance, as they are well suited to seeding on mineral soil.

The shrub cover is higher than the Series average of 51 percent. The common shrubs include dwarf Oregongrape, hairy honeysuckle, poison oak, bald-hip rose, and creeping snowberry. The hairy honeysuckle and poison oak are indicative of the hot, dry environmental conditions. Herb cover is below average for the Series. Common herbs include pathfinder, Oregon fairybell, rattlesnake-plantain, western twinflower, western sword-fern, snow-queen, western starflower, and stream violet.

**SILVICULTURE:** Douglas-fir, white fir, ponderosa pine, incense-cedar, western redcedar, and western hemlock are suitable for reforestation. On the driest sites, Douglas-fir, white fir, and ponderosa pine would be suitable; while in the moister concavities, western hemlock and western redcedar would be appropriate. The advance regeneration of white fir would be suitable for inclusion in the next stand

if it can be protected from logging damage. *Annosus* root rot, caused by *Fomes annosus*, and *Armillaria* root rot, caused by *Armillaria mellea*, may infect white fir through wounds. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO/RHDI is below average for the White Fir Series.

Total shrub cover ranges from 45 to 116 percent, with an average of 78.7 percent, which is above average for the White Fir Series. Most of the cover is dwarf Oregongrape, salal, and whipplevine. Herb cover is below average for the Series, ranging from 20 to 56 percent, with an average of 36 percent.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 45 to 65 inches, with an average of 53.3 inches. Most of it occurs as rain from October through April, with only 7 to 8 inches falling during the dry season (May through September). Sample plots were located on both pumice and andesite, between 2100 and 2400 feet, on slopes from 20 to 50 percent. See the Umpqua National Forest SRI for site specific information.

Shrub cover is above average for the Series and the herb cover is below average. The rate of revegetation following disturbance would be moderate to rapid, with the hot climate, moderate precipitation and nearby seed sources. ABCO/RHDI is usually found on middle to upper third of the slopes and usually not in riparian areas or wetlands; however, the presence of western redcedar and Pacific yew

indicate pockets of high humidity and/or soil moisture.

**FIRE MANAGEMENT:** Evidence of fire was found in 1 of the 3 sample plots. Fires would be frequent in this Association, resulting from the highest mean annual temperatures of the White Fir Series. Both intense stand regenerating fires and less intense underburns occur. The presence of ponderosa pine and Pacific madrone on all plots is evidence of past fire history.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited with sparse cover of palatable shrubs and moderate amounts of herbage. Browse species such as California hazel, creambush ocean-spray, black raspberry, thimbleberry, creeping snowberry, and red huckleberry are sparsely scattered through the stands. Water is frequently available with 3.2 intermittent or larger streams per mile.

Stands are generally two storied with patches of hiding cover of shrubs and regeneration, and down woody material.

**RECREATION & VISUAL MANAGEMENT:** ABCO/RHDI is at the warm end of the White Fir Series. Generally it is found on the upper slopes of lower elevation ridges, with little outstanding recreational interest and only occasional vistas. The presence of poison oak and a moderate cover of shrubs also deters recreation.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	33%	2.0	.0	fire resistant seral dry, hot environment and fire history
CADE3	incense-cedar	100%	12.0	7.8	
PILA	sugar pine	100%	4.0	1.7	
PIPO	ponderosa pine	66%	5.0	.0	
PSME	Douglas-fir	100%	39.0	16.5	
	TOTAL OVERSTORY	100%	59.0	12.5	
ABCO	—CONIFERS— white fir	100%	58.3	24.7	add to species diversity hotter, drier sites
CADE3	incense-cedar	33%	12.0	.0	
PIPO	ponderosa pine	33%	4.0	.0	
PSME	Douglas-fir	33%	2.0	.0	
TABR	Pacific yew	66%	5.0	2.8	
THPL	western redcedar	33%	8.0	.0	pockets of high humidity warmer, wetter areas moderate, wetter conditions
TSHE	western hemlock	33%	10.0	.0	
	—HARDWOODS—				
ACMA	big-leaf maple	33%	12.0	.0	wetter conditions
ARME	Pacific madrone	100%	5.0	3.0	recent fire history
CACH	golden chinquapin	33%	5.0	.0	shallow, rocky soils
	TOTAL UNDERSTORY	100%	84.3	22.5	
BENE	dwarf Oregongrape	100%	16.0	12.2	moderate climate
CONU	Pacific dogwood	66%	5.0	4.2	
COCOC	California hazel	33%	3.0	.0	
GASH	salal	66%	32.5	31.8	
HODI	creambush ocean-spray	66%	6.0	1.4	
LOHI	hairy honeysuckle	100%	1.7	1.2	dry site indicator hot, dry site indicator
RHDI	poison oak	100%	7.0	2.6	
ROGY	baldhip rose	100%	4.7	4.6	
RULE	black raspberry	33%	2.0	.0	
RUPA	thimbleberry	33%	2.0	.0	
RUUR	Pacific blackberry	66%	4.0	1.4	
SYMO	creeping snowberry	100%	2.0	1.0	
VAPA	red huckleberry	33%	1.0	0	
WHMO	whipplevine	100%	13.0	1.7	
	TOTAL SHRUB	100%	78.7	35.6	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	66%	3.0	2.8	moist, cool environments  generally productive sites drier, warmer sites  mid successional
ADBI	trail-plant, pathfinder	100%	2.0	1.0	
ANDE	threeleaf anemone	33%	2.0	0	
CASC2	rough harebell	33%	1.0	0	
CIRSI		33%	1.0	.0	
DIFO	Pacific bleedingheart	33%	1.0	.0	
DIHOO	Oregon fairybell	100%	2.3	1.2	
FRVEB	woods strawberry	66%	2.0	1.4	
GAAP	catchweed bedstraw	33%	8.0	.0	
GOOB	rattlesnake-plantain	100%	1.0	.0	
HYPE	Klamath weed	33%	1.0	.0	
IRIS	iris spp.	33%	1.0	.0	
LIBOL	western twinflower	100%	6.0	2.6	
OSCH	mountain sweet-root	66%	1.5	7	
PHAD	woodland phlox	33%	1.0	.0	
POMU	western sword-fern	100%	4.0	1.7	
SADO	yerba buena	66%	2.0	1.4	
SYRE	snow-queen	100%	3.0	1.0	
TRLA2	western starflower	100%	2.7	2.9	
VAHE	white inside-out-flr	66%	2.5	.7	
VIAM	American vetch	33%	1.0	.0	
VIAD	early blue violet	33%	1.0	0	
VIGL	stream violet	100%	1.7	1.2	
	TOTAL HERB	100%	36.0	18.3	
BRPA	Pacific brome	66%	1.0	0	
FEOC	western fescue	66%	1.5	.7	
	TOTAL GRASS	100%	1.7	.6	

**WHITE FIR - INCENSE-CEDAR / DWARF OREGONGRAPE**  
*Abies concolor* - *Calocedrus decurrens* / *Berberis nervosa*  
**ABCO-CADE3/BENE**

**EXTENT:** ABCO-CADE3/BENE occurs on all Ranger Districts on the Rogue River and Umpqua National Forests. N = 24 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of white fir and incense-cedar in the understory, combined with the absence of Piper's Oregon-grape, Douglas maple, and snow bramble, distinguishes ABCO-CADE3/BENE from other White Fir Associations. Occasionally western serviceberry and/or poison oak may be present, but in minor amounts (cover less than 5 percent).

**ABIOTIC ENVIRONMENT:** ABCO-CADE3/BENE is found at a wide range of elevations, from 2300 feet to 5100 feet, on the upper and middle third of the slopes, on all aspects. Slopes are moderate, and are moderately dissected with 2.7 intermittent or larger streams per mile. Parent materials are usually andesite and basalt, though it is also found on breccia and tephra. Soil depths and rooting depths are about average for the Series. Total basal area is above the Series average of 290 square feet.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3936.0	792.0
Aspect (deg)	246.3	83.8
Slope (%)	33.2	15.1
Total soil depth (in)	41.8	12.7
Rooting depth (in)	46.8	7.8
Total basal area (ft <sup>2</sup> /ac)	313.6	81.5

**CLIMATE:** Relative to the White Fir Series and to the Cascade Province, ABCO-CADE3/BENE is in the middle of the environmental grid with moderate temperatures and moderate precipitation. Moisture stress late in the growing season limits biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	45.0	2.1
Maximum month temp (F)	78.8	3.2
Mean annual ppt (in)	55.2	9.4
Dry season ppt (in)	7.7	1.0

**FOREST FLOOR:** Litter is slightly less than the Series average and moss cover is slightly higher. The mesic conditions allow moss growth and litter decomposition.

FOREST FLOOR	MEAN	S.D.
Litter (%)	92.0	8.5
Moss (%)	10.3	16.7
Bareground (%)	4.0	5.9
Gravel (%)	1.8	2.9
Rock (%)	4.5	8.4
Bedrock (%)	.3	1.0

**VEGETATION:** Douglas-fir dominates the overstory, incense-cedar and white fir are common and sugar pine is occasional. In the understory, white fir or incense-cedar dominates, with Douglas-fir found commonly, and sugar pine, western white pine, ponderosa pine, Pacific yew, and western hemlock rarely. Chinquapin is also common in the understory. Western white pine will be found on the frosty sites, Pacific yew on the high humidity sites, and ponderosa pine on the drier sites with a greater fire frequency. White fir, incense-cedar, Douglas-fir, and sugar pine will invade after a disturbance. All are well suited to seeding on mineral soil, however, on frosty sites, Douglas-fir will not survive and grow as well as western white pine or ponderosa pine.

Shrub cover is below the Series average of 51 percent. Common shrubs include dwarf Oregon-grape, baldhip rose, and Pacific blackberry. Herb cover is also slightly less than the Series average. Common herbs include western starflower, vanilla leaf, and western twinflower.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, sugar pine, western white pine, and ponderosa pine would be appropriate for regeneration. For diversity, Pacific yew would do well in areas of high humidity, and golden chinquapin on areas with shallow, rocky soils. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO-CADE3/BENE is slightly above average for the White Fir Series.

Total shrub cover ranges from 10 to 83 percent, with an average of 36.8 percent, which is below average for the White Fir Series. Most of the shrub cover is dwarf Oregon grape. Vine maple, big-leaf maple, and golden chinquapin have low covers. Total herb cover is average, ranging from 9 to 109 percent, with an average of 42.1 percent, slightly less than the Series average.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 70 inches, with an average of 55.2 inches. Most of it occurs as rain from the October through April, with only 6 to 10 inches falling during the dry season (May through September).

**ABCO-CADE3/BENE** is found on a wide variety of parent materials so it is not appropriate to generalize soil descriptions. Shrub and herb covers are below average for the White Fir Series and the revegetation rate following disturbance should be moderate. The Association has been found in a basin or the edge of a wetland, however, it is generally not found in riparian areas or wetlands.

**FIRE MANAGEMENT:** Evidence of fire was found in 17 of the 24 sample plots. Fire frequency was around 65 to 100 years with stand ages ranging from 100 to 320 years. The southwesterly slopes

and the position on the upper to middle third of the slopes would result in early season drying and more frequent lightening strikes. Underburning is common.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is low, with little cover of palatable shrubs and generally low cover of herbs. Browse species such as Pacific dogwood, California hazel, black raspberry, thimbleberry, Pacific blackberry, willow species, and red huckleberry are scattered throughout the stands. Water is available with 2.7 intermittent or permanent streams per mile.

Generally the stands are young and have dense canopies, providing good thermal cover. Depending on the density of regeneration and shrub layer, patches of hiding cover may exist. There is a heavy layer of down, woody material in most stands.

**RECREATION & VISUAL MANAGEMENT:** From a recreational and visual standpoint, **ABCO-CADE3/BENE** is typical of the Cascades. It is generally found on slopes and away from areas of recreational interest such as stream bottoms or ridgetops. There are no outstanding features and the potential for berry picking is low.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	54%	21.8	19.0	cold, moderate sites fire resistant  less susceptible to root disease recent fire history
ABMAS	Shasta red fir	4%	25.0	.0	
CADE3	incense-cedar	70%	15.2	10.5	
PILA	sugar pine	37%	8.7	4.7	
PIMO	western white pine	4%	3.0	.0	
PIPO	ponderosa pine	8%	3.5	2.1	
PSME	Douglas-fir	100%	39.0	19.9	
	TOTAL OVERSTORY	100%	66.3	17.7	
ABCO	—CONIFERS— white fir	87%	34.0	19.7	intermediate in light tolerance susceptible to blister rust hotter, drier sites warmer, drier conditions pockets of high humidity warmer, moister conditions
CADE3	incense-cedar	100%	11.7	6.7	
PILA	sugar pine	20%	2.4	3.1	
PIMO	western white pine	8%	3.5	3.5	
PIPO	ponderosa pine	4%	2.0	.0	
PSME	Douglas-fir	66%	13.6	7.9	
TABR	Pacific yew	12%	6.3	7.6	
TSHE	western hemlock	8%	2.0	1.4	
	—HARDWOODS— vine maple	20%	20.2	22.4	
ACMA	big-leaf maple	8%	12.5	10.6	
ALRU	red alder	4%	1.0	.0	moist areas
ARME	Pacific madrone	16%	5.8	3.2	moist areas
CACH	golden chinquapin	50%	5.5	4.1	evidence of recent fire history
	TOTAL UNDERSTORY	100%	61.3	23.1	shallow, rocky soils
AMAL	western serviceberry	4%	5.0	.0	indicates recent soil disturbance and dry sites
ARCO3	hairy manzanita	4%	1.0	.0	
ARPA	greenleaf manzanita	4%	1.0	0	
BENE	dwarf Oregongrape	91%	9.5	7.2	hot, dry areas, very successful in clearcuts
CHME	little prince's-pine	25%	1.2	4	deep, fertile soils
CHUM	common prince's-pine	58%	4.2	3.9	generally warm and dry, well-drained sites
CONU	Pacific dogwood	29%	2.0	.8	
COCOC	California hazel	58%	4.6	4.0	
GASH	salal	12%	2.7	2.1	hot, dry conditions
HODI	creambush ocean-spray	41%	9.7	12.8	
LOCI	trumpet honeysuckle	12%	1.3	6	
LOHI	hairy honeysuckle	12%	1.3	.6	hot, dry conditions
PAMY	Oregon boxwood	16%	5.8	6.6	moist, well-drained sites
PHCA3	Pacific ninebark	4%	1.0	.0	
RHPU	cascara	4%	1.0	.0	
RHMA	Pacific rhododendron	8%	6.5	2.1	moist sites
RHDI	poison oak	4%	2.0	0	shallow, well-drained soil, generally low in nutrients
RIBES	currant spp.	8%	2.0	1.4	hot, dry conditions
RIBI	Siskiyou gooseberry	4%	1.0	0	alternate host for blister rust
RILA	swamp gooseberry	8%	2.0	0	moist areas
ROGY	baldhip rose	87%	3.9	2.7	
RULE	black raspberry	4%	1.0	0	
RUPA	thimbleberry	16%	2.8	2.2	moist, cold environments, higher elevations
RUUR	Pacific blackberry	83%	3.4	2.8	
SALIX	willow spp.	8%	1.5	7	
SYAL	common snowberry	8%	3.0	2.8	not on cold, frosty sites
SYMO	creeping snowberry	54%	5.3	4.3	
VAME	thin-leaved huckleberry	16%	7.3	7.4	
VAPA	red huckleberry	8%	1.5	.7	
WHMO	whipplevine	58%	6.5	5.3	
	TOTAL SHRUB	100%	36.8	22.7	



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	45%	15.7	13.1	cold sites, mid to late successional
ACRU	baneberry	4%	3.0	.0	
ADBI	trail-plant, pathfinder	66%	4.0	4.5	
ANDE	threeleaf anemone	70%	2.1	1.4	cool, dry to moist forest or openings cooler, more moist sites than ARCO
ARMA3	bigleaf sandwort	41%	2.0	2.3	
ARCO	heart-leaf arnica	4%	60.0	.0	
ARLA	mountain arnica	12%	6.0	5.6	
ASCA3	western wild ginger	16%	2.8	1.7	
ASHA	marbled wild ginger	16%	1.5	1.0	
CABU2	fairy-slipper	4%	1.0	.0	
CAPR3	California harebell	8%	1.0	.0	
CASC2	rough harebell	54%	2.6	2.8	
CLUN	queen's cup	29%	1.9	1.5	
CORAL	coral-root	4%	1.0	.0	generally moist or shaded areas
COMA3	spotted coral-root	20%	1.0	.0	
COME	Pacific coral-root	4%	1.0	.0	
COST2	hooded coral-root	4%	1.0	.0	
CYGR	Pacific hound's-tongue	4%	10.0	0	
DIHOO	Oregon fairybell	70%	1.2	4	
EBAU	phantom-orchid	4%	1.0	0	
FRVEB	woods strawberry	54%	2.6	2.5	
GAAP	catchweed bedstraw	45%	1.5	8	
GAOR	Oregon bedstraw	4%	2.0	0	
GOOB	rattlesnake-plantain	62%	1.0	0	found everywhere except in hot and dry or extremely cold environments
HAUN	Alaska bog-orchid	4%	1.0	.0	mid to late successional
HEMI	smallflower alumroot	4%	1.0	.0	
HIAL	white-flowered hawkweed	70%	1.2	.4	
IRIS	iris spp.	8%	1.0	.0	
LAPO	leafy peavine	29%	3.3	3.1	
LICO4	tiger lily	4%	1.0	.0	
LIBOL	western twinflower	62%	6.8	5.8	
MAMA	woodland tarweed	8%	1.5	7	
MITR2	three-tooth mitrewort	12%	1.3	.6	
MOPE	miner's lettuce	4%	1.0	0	
MOSI	candyflower	4%	1.0	.0	generally productive sites often invades after heavy disturbance
NEHE	small white nemophila	12%	1.0	0	
OSCH	mountain sweet-root	33%	2.5	2.6	
PERA	leafy lousewort	4%	1.0	0	
PHACE		4%	1.0	0	
PHAD	woodland phlox	16%	1.0	0	
POMU	western sword-fern	33%	2.1	1.6	
PTAQ	bracken	33%	2.1	2.1	
PYAP	leafless pyrola	16%	1.0	.0	
PYPI	whitevein pyrola	33%	1.3	.7	
PYSE	one-sided pyrola	16%	1.3	5	dry, shady forests
SADO	yerba buena	4%	1.0	0	cool to cold, moist to wet sites with heavy snowpack
SMRA	western false Solomon's-seal	16%	1.3	5	
SMST	starry false Solomon's-seal	41%	2.8	1.1	
SYRE	snow-queen	45%	1.8	1.4	
TITR	foamflower	8%	1.0	0	
TRLA2	western starflower	95%	2.1	1.2	
TROV	white trillium	66%	1.1	5	
VASI	mountain heliotrope	4%	1.0	.0	
VAHE	white inside-out-flr	45%	3.1	2.9	
VECA	Calif. false hellebore	4%	2.0	0	
VIAM	American vetch	16%	7.0	8.7	
VIAD	early blue violet	4%	2.0	0	
VIGL	stream violet	29%	1.6	1.1	

VIOR2	round-leaved violet	33%	1.1	.4	mesic sites cold, dry to moist sites
XETE	common beargrass	8%	3.5	2.1	
	TOTAL HERB	100%	42.1	29.6	
BROMU	brome spp.	4%	1.0	.0	
BRER	meadow brome	4%	1.0	.0	
BRPA	Pacific brome	33%	3.1	4.8	
FESTU	fescue spp.	4%	2.0	.0	
FEOC	western fescue	8%	1.0	.0	
FERU	red fescue	8%	1.0	.0	
MEHA	Harford's melic	4%	4.0	.0	
MESU	Alaska oniongrass	20%	1.8	1.3	
	TOTAL GRASS	100%	2.0	3.2	

**WHITE FIR - DOUGLAS-FIR / PIPER'S OREGONGRAPE**  
*Abies concolor* - *Pseudotsuga menziesii* / *Berberis piperiana*  
**ABCO-PSME/BEPI**

**EXTENT:** ABCO-PSME/BEPI is found on Ashland, Butte Falls and Prospect Ranger Districts, Rogue River National Forest and Tiller, Diamond Lake and North Umpqua Ranger Districts of the Umpqua National Forest. N = 27 plots.

**IDENTIFYING CHARACTERISTICS:** The presence of white fir and Douglas-fir in the understory and Piper's Oregongrape in the shrub layer, combined with the absence or very low percent cover of salal, differentiates this Association from the other White Fir Associations and the Douglas-fir Associations.

**ABIOTIC ENVIRONMENT:** ABCO-PSME/BEPI is found at the lower elevations of the White Fir Series, ranging from 2100 feet to 4500 feet, on upper to lower third of slopes, with southeast to northwest aspects. The slopes are moderate, and are moderately dissected with 3.7 intermittent or permanent streams per mile. Parent materials are varied, ranging from ash/tephra to diorite/gabbro, but the majority is andesite/basalt. Soil depths are slightly below the Series average, for both total and rooting depths. Total basal area is average for the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3260.0	640.0
Aspect (deg)	222.3	60.7
Slope (%)	36.1	20.1
Total soil depth (in)	37.1	13.9
Rooting depth (in)	42.7	10.6
Total basal area (ft <sup>2</sup> /ac)	301.1	74.0

**CLIMATE:** Relative to the White fir Series and to the Cascade Province, ABCO-PSME/BEPI is at the warm, dry end of the environmental grid. Temperatures are warmer than the Series average and the precipitation is less. Moisture limitation late in the growing season limits biomass production.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.8	1.7
Maximum month temp (F)	81.5	2.5
Mean annual ppt (in)	51.4	11.1
Dry season ppt (in)	7.1	1.3

**FOREST FLOOR:** Litter cover is less than the Series average and the moss cover is greater, indicating the warmer conditions that increase litter decomposition rates and moss growth.

FOREST FLOOR	MEAN	S.D.
Litter (%)	89.2	13.0
Moss (%)	13.1	18.3
Bareground (%)	2.7	4.6
Gravel (%)	3.8	10.6
Rock (%)	6.0	15.4
Bedrock (%)	1.0	2.7

**VEGETATION:** The overstory is dominated by Douglas-fir with incense-cedar, sugar pine, ponderosa pine, and white fir occasionally present. Shasta red fir, western white pine, and western hemlock rarely occur. The understory is dominated by white fir or Douglas-fir, and incense-cedar is common. Sugar pine is occasionally in the understory and western white pine, ponderosa pine, Pacific yew, and western hemlock are rare. White fir, Douglas-fir, incense-cedar, and sugar pine will invade after a disturbance as all are well suited to seeding on mineral soil.

The shrub cover is slightly less than the Series average of 51 percent. The shrub layer usually includes Piper's Oregongrape, as well as dwarf Oregongrape, baldhip rose, Pacific blackberry, whipplevine, and creeping snowberry. The herb layer is also less than the Series average of 47 percent. Common herbs include pathfinder, Oregon fairybell, rattlesnake-plantain, white-flowered hawkweed, western starflower, and western twinflower.

**SILVICULTURE:** White fir, Douglas-fir, incense-cedar, sugar pine, western white pine, and pon-

derosa pine are appropriate for regeneration. Western white pine and ponderosa pine would be suitable for frosty microsites. For diversity, golden chinquapin would be good on shallow, rocky soils. Douglas-fir and white fir are the most productive species on the sites. The total basal area for ABCO-PSME/BEPI is slightly above average for the White Fir Series.

Total shrub cover ranges from 14 to 96 percent, with an average of 46 percent, slightly below average for the Series. Most of the cover is from a variety of species. Herb covers are slightly below average for the Series, ranging from 8 to 115 percent, with an average of 38 percent.

**WATERSHED MANAGEMENT:** Mean annual precipitation ranges from 40 to 70 inches, with an average of 51.4 inches. Most of it occurs as rain from autumn through spring, with 6 to 10 inches falling during the dry season (May through September).

The Association occurs on a wide variety of parent materials so it is inappropriate to generalize about the soils. See the appropriate Forest SRI for site specific information. Shrub and herb cover are slightly below average for the Series and revegetation following disturbance should be moderate.

**FIRE MANAGEMENT:** Evidence of fire was found in 18 of the 27 sample plots. Frequency of fires is about 75 to 100 years. More frequent, lower intensity fires are the norm in contrast to the higher elevation White Fir Associations.

**RANGE & WILDLIFE MANAGEMENT:** Wildlife forage and domestic range use is limited, with few palatable shrubs and only moderate herbage. Browse species such as deerbrush, Pacific dogwood, California hazel, dwarf bramble, thimbleberry, salmonberry, and Pacific blackberry are scattered through the stands. Water is frequently available with 3.7 intermittent or permanent streams per mile.

Most of the stands provide thermal cover, with some patches of hiding cover of shrubs and regeneration. Down woody material ranges from high to low concentrations.

**RECREATION & VISUAL MANAGEMENT:** From a recreational and visual standpoint, ABCO-PSME/BEPI is typical of the lower elevation southern Oregon Cascades. Some stands are located on ridgetops, providing views of the surrounding areas. A wide variety of wild flowers appear in the spring. Berry picking opportunities are few and far between.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	29%	21.2	13.6	found on cold, moderate sites co-climax, fire resistant more seral in behavior less susceptible to root disease evidence of fire history
ABMAS	Shasta red fir	3%	6.0	.0	
CADE3	incense-cedar	48%	15.2	9.9	
PILA	sugar pine	33%	6.6	3.6	
PIMO	western white pine	7%	10.0	.0	
PIPO	ponderosa pine	18%	22.0	27.4	
PSME	Douglas-fir	100%	44.9	21.3	
TSHE	western hemlock	3%	5.0	.0	found mostly north of Butte Falls RD
	TOTAL OVERSTORY	100%	66.0	16.9	
ABCO	—CONIFERS— white fir	85%	24.5	19.3	somewhat drought tolerant intermediate in light tolerance hot, dry sites or frosty sites  slow growing; high diversity and maybe medicinal value warmer, moister sites
CADE3	incense-cedar	81%	12.0	8.8	
PILA	sugar pine	25%	4.9	3.9	
PIMO	western white pine	7%	2.0	1.4	
PIPO	ponderosa pine	7%	5.5	.7	
PSME	Douglas-fir	88%	21.1	15.7	
TABR	Pacific yew	11%	2.7	2.1	
TSHE	western hemlock	11%	7.0	7.2	
	—HARDWOODS— vine maple	14%	20.0	12.9	
ACCI	big-leaf maple	18%	4.2	3.8	
ARME	Pacific madrone	48%	9.1	7.2	moist areas
CACH	golden chinquapin	33%	7.2	7.4	evidence of recent fire history
QUCH	canyon live oak	11%	4.3	3.2	shallow, rockier soils
	TOTAL UNDERSTORY	100%	63.3	27.2	hot, dry conditions
AMAL	western serviceberry	18%	1.4	.5	deep, fertile soils
BENE	dwarf Oregongrape	85%	7.7	6.3	
BEPI	Piper's Oregongrape	100%	4.1	3.2	
CEIN	deerbrush	18%	2.0	1.0	drier, rockier, less productive sites than where BENE occurs
CHME	little prince's-pine	14%	1.0	0	
CHUM	common prince's-pine	51%	2.9	2.2	
CONU	Pacific dogwood	22%	5.2	2.8	sprouts following fire
COST	red-osier dogwood	3%	1.0	.0	
COCOC	California hazel	59%	6.4	7.3	
GAFR	Fremont silk-tassel	7%	4.0	1.4	dry, sunny sites
GASH	salal	7%	2.0	.0	
HODI	creambush ocean-spray	66%	11.5	13.5	
LOCI	trumpet honeysuckle	11%	2.0	1.0	dry sites
LOHI	hairy honeysuckle	11%	2.0	1.7	
PAMY	Oregon boxwood	14%	2.3	1.0	
RHPU	cascara	3%	1.0	0	hot, dry sites, often rocky, well-drained soils
RHMA	Pacific rhododendron	3%	5.0	0	
RHDI	poison oak	22%	4.2	5.4	
RIBES	currant spp.	3%	2.0	.0	moist to wet site indicator
ROGY	baldhip rose	96%	2.8	1.4	
RULA	dwarf bramble	3%	1.0	0	
RUPA	thimbleberry	18%	2.0	1.0	common
RUSP	salmonberry	3%	1.0	0	
RUUR	Pacific blackberry	81%	3.6	2.5	
SYAL	common snowberry	25%	3.0	2.8	warm, dry sites
SYMO	creeping snowberry	77%	5.9	5.3	
VAME	thin-leaved huckleberry	7%	2.5	.7	
WHMO	whipplevine	81%	7.6	6.4	cool sites, well drained soils
	TOTAL SHRUB	100%	45.7	22.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	59%	10.6	12.7	
ADBI	trail-plant, pathfinder	74%	3.2	2.7	
ADCA	Venus-hair fern	3%	1.0	.0	
AGUR	nettle-leaf horse-mint	3%	1.0	.0	
ANDE	threeleaf anemone	51%	2.5	2.8	
APAN	spreading dogbane	7%	1.5	.7	
ARMA3	bigleaf sandwort	40%	1.6	.8	
ARCO	heart-leaf arnica	14%	2.5	1.9	
ASCA3	western wild ginger	3%	1.0	.0	
ASHA	marbled wild ginger	7%	2.0	1.4	
ASTER		3%	1.0	.0	
BADE	Puget balsamroot	3%	2.0	.0	
CABU2	fairy-slipper	3%	1.0	.0	
CAPR3	California harebell	18%	1.2	.4	
CASC2	rough harebell	44%	1.8	1.3	
CLUN	queen's cup	7%	1.5	.7	
COHE	varied-leaved collomia	7%	1.0	.0	
COLA	cutleaf goldthread	3%	1.0	.0	
CORAL	coral-root	3%	1.0	.0	
COME	Pacific coral-root	3%	1.0	.0	
COCA	bunchberry	3%	1.0	.0	indicates cool, mesic sites
DIHOO	Oregon fairybell	66%	1.8	1.4	
EBAU	phantom-orchid	7%	1.0	.0	
FRVEB	woods strawberry	51%	1.8	.8	
GAAP	catchweed bedstraw	59%	1.2	.4	
GAOR	Oregon bedstraw	11%	1.7	1.2	
GOOB	rattlesnake-plantain	66%	1.1	.2	
HAL	white-flowered hawkweed	66%	1.4	.7	
IRIS	iris spp.	11%	1.3	.6	
IRCH	slender-tubed iris	11%	1.0	.0	
IRTEK	Oregon iris	3%	1.0	.0	
LAPO	leafy peavine	40%	9.9	12.0	fixes nitrogen
LIAP	celery-ld licorice-rt	3%	2.0	.0	
LIWA	Washington lily	7%	1.0	.0	fragrant flowers
LIBOL	western twinflower	62%	6.5	5.9	
LICA3	northwest listera	3%	1.0	.0	
LUPIN	lupine spp.	3%	1.0	.0	
LUCA	tailcup lupine	3%	1.0	.0	
MAMA	woodland tarweed	33%	1.0	.0	
MECI	ciliate bluebells	3%	1.0	.0	
MITR2	three-tooth mitrewort	3%	1.0	.0	
MOSI	candyflower	14%	1.3	.5	
NEHE	small white nemophila	7%	1.0	.0	
OSCH	mountain sweet-root	40%	1.7	.9	
PHAD	woodland phlox	11%	1.0	.0	
PHSP	showy phlox	3%	3.0	.0	
POMU	western sword-fern	48%	3.0	2.4	
PTAQ	bracken	44%	2.3	2.1	often invades after heavy disturbance
PTAN	woodland pinedrops	3%	1.0	.0	
PYAP	leafless pyrola	11%	1.0	.0	
PYPI	whitevein pyrola	11%	1.0	.0	
PYSE	one-sided pyrola	3%	1.0	.0	
SADO	yerba buena	18%	3.4	4.8	
SIHO	Hooker's silene	3%	1.0	.0	
SMRA	western false Solomon's-seal	18%	1.0	.0	
SMST	starry false Solomon's-seal	11%	1.0	.0	
SYRE	snow-queen	51%	1.5	.8	
THMO	mountain thermopsis	3%	1.0	.0	
TRLA2	western starflower	81%	2.4	1.1	

TROV	white trillium	25%	1.3	.8	moist sites, mid successional
VAHE	white inside-out-flr	40%	2.6	1.9	
VECA	Calif. false hellebore	3%	1.0	.0	
VIAM	American vetch	33%	2.7	2.9	
VIGL	stream violet	18%	1.8	.8	
VIHA	Hall's violet	3%	2.0	.0	
VIOR2	round-leaved violet	22%	2.8	3.5	
XETE	common beargrass	3%	2.0	0	
	TOTAL HERB	100%	38.1	23.7	
BROMU	brome spp.	3%	2.0	.0	
BRPA	Pacific brome	62%	2.4	2.3	
CAREX	sedge spp.	7%	2.0	1.4	
CYEC	hedgehog dogtail	3%	1.0	.0	
ELGL	blue wildrye	3%	1.0	.0	
FEID	Idaho fescue	11%	1.0	.0	
FEOC	western fescue	29%	1.0	.0	
FERU	red fescue	3%	1.0	.0	
HOLA	commom velvet-grass	3%	1.0	0	
MESU	Alaska oniongrass	14%	1.8	1.0	
	TOTAL GRASS	100%	2.7	2.3	

# DOUGLAS-FIR SERIES

## *Pseudotsuga menziesii*

### PSME

Douglas-fir, the most common, dominant and versatile species in the Pacific Northwest, occurs prominently in all Series in the Area. It occurs at the immediate coast, near sea level, and in the High Cascades above 5500 feet in elevation. It competes well on most parent rock types, aspects, and slopes. It behaves as a drought tolerant pioneer, with moderate tolerance to shade. It is best described as a generalist. It occurs in all Series and at elevations ranging from about sea level to 5500 feet. Rather than parent rock type, soil depth, or aspect, its regeneration is associated with recently disturbed ground. Its presence in the overstory indicates disturbance. But its presence and dominance in the understory can indicate hot, dry conditions characteristic of the Series. Ponderosa pine and incense-cedar are the only major conifers with greater tolerance to drought (Minore 1979). Douglas-fir produces well in temperatures near 80 degrees F (Cleary and Waring 1969) and survives in less than 2 percent of full sunlight for at least several decades (Atzet and Waring 1970). However, it is not known for its frost tolerance.

## THE SERIES

**EXTENT:** Associations of the Douglas-fir Series occur with increasing frequency from north to south. The Cottage Grove Ranger District has one established plot, the North Umpqua Ranger District has three, but Tiller has over 10. The Series is more common on the Rogue River National Forest. N = 26 plots.

**ABIOTIC ENVIRONMENT:** Except for the isolated occurrences of climax stands of Oregon white oak, the Series occurs in the hottest, driest forest environments in southwest Oregon. The average elevation is the lowest of the coniferous Series (2879 feet) and the aspect is the hottest at 189 degrees. Slopes average 21.8 percent, the steepest Series in the

Cascades, and the associations occur more often on upper slope and ridgetop positions.

Soils generally are shallower, 37 inches, than the average Cascade soil, 40 inches. Thirty seven inches is certainly adequate, and temperature usually is not a limiting factor. Thus, where moisture is available well into June or July, biomass productivity is higher than the average Cascade site. Much of the biomass is produced in the shrub layer. The average Cascade site produces approximately 57 percent shrub cover. The PSME Series averages 78 percent. Recent studies have indicated that 60 percent shrub cover significantly reduces survival and growth of conifer crop trees. Vegetation management, or the directing of resources to the tree layer, will increase timber volume production.

ABIOTIC	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Elevation (ft)	2090	4130	2040	2892.0	627.0	
Aspect (deg)	-	-	-	189.2	74.4	
Slope (%)	7	75	68	44.2	21.4	
Total soil depth (in)	11.8	50.0	38.2	38.0	13.0	
Rooting depth (in)	15.7	50.0	34.3	42.4	11.7	
Total basal area (ft <sup>2</sup> /ac)	100	420	320	240.0	72.3	

**CLIMATE:** Average annual precipitation is estimated to be 56 inches with light to no snowpack, and dry season precipitation averages about 7 inches (Figure 11). Average annual temperature is 48 de-

grees F. Maximum summer temperature averages about 83 degrees F. Precipitation and temperature figures are the lowest and highest, respectively, for all Series except oak. Moisture deficit can occur as early as late April.



CLIMATE	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Mean annual temp (F)	44.8	50.0	5.2	47.8	1.6	highest of all Series
Maximum month temp (F)	78.1	86.4	8.3	83.0	2.5	highest of all Series
Mean annual ppt (in)	35	70	35	55.8	11.5	below population average
Dry season ppt (in)	6	9	3	7.3	1.2	lowest of all Series

**FOREST FLOOR:** Frequent low intensity fires may be responsible for eliminating some of the coarse litter (stems and branches). Fine litter is replaced on a shorter cycle and is usually present. Decomposi-

tion is likely limited by lack of moisture. However, when moisture levels are adequate, decomposition rates are probably rapid.

FOREST FLOOR	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
Litter (%)	20	100	80	88.9	15.9	
Moss (%)	0	75	75	13.8	18.9	
Bareground (%)	0	15	15	2.5	3.6	
Gravel (%)	0	10	10	1.4	2.4	
Rock (%)	0	8	8	1.6	2.5	
Bedrock (%)	0	12	12	.8	2.5	

**VEGETATION:** Douglas-fir is not particular. It associates with virtually every species that occurs in southwest Oregon. For example, at high elevations it is found with subalpine fir, mountain hemlock, and lodgepole pine. At lower elevations it associates with ponderosa pine, coast redwood, and big-leaf maple. It is most commonly found with white fir and western hemlock. The list of associated shrubs, herbs, and grasses includes most common forest species.

**SILVICULTURE:** The hot, dry environment is the most important factor limiting biomass productivity. Problems with moisture stress will be magnified where soils are shallow, sites are exposed and evaporative demands are high, plant cover is high, management creates large openings on southern aspects, and soils are poorly treated.

Management of hardwood and shrub competition will be a major consideration on many sites. Silvicultural prescriptions should include consideration of pre-harvest activities that tend to reduce the competition problem. Stands in this Series should be managed with vegetation management as a major consideration.

Regeneration potential is low. Both natural and planted stock have high mortality rates. Again, moisture stress is the primary cause. Management activities that reduce leaf temperature, decrease va-

por pressure deficits, and increase soil moisture availability are obviously recommended.

**WATERSHED MANAGEMENT:** Soils are well to excessively drained, with rapid to moderately rapid permeability. The risk of mass wasting, surface erosion, and creating turbidity is moderate. Shrub cover is high and rooting depth is deep. Grasses protect the surface layers and all species are potentially usable for erosion control.

**FIRE MANAGEMENT:** Stands in the PSME Series generally are young and highly disturbed relative to other Series. Fire is the most evident agent of disturbance. Insect damage is common, but much less obvious. Several stands were evidently burned, on the average, at 50 year intervals. At the other extreme, stands over 250 years old showed no evidence of having ever been burned. However, fire has played a major role in shaping the composition and structure of most stands. Douglas-fir, the dominant component of both the overstory and regeneration layers, generously produces fuels. Heavy needle drop produces fine fuel, and self-pruning branches tend to quickly accumulate after stand closure. Although Douglas-fir itself, due to its self-pruning, tends not to create a fuel ladder, understory tree regeneration and shrubs quickly develop in canopy gaps and provide continuous vertical distribution of fuels. Moreover, the hot, dry environment of the Series tends to dry fuels. It is likely that ground

fire would carry well by mid to late spring in most early seral stands.

**RANGE AND WILDLIFE MANAGEMENT:** Spring forbs are abundant and winter browse is available. Cover, both thermal and hiding, varies from common to scattered. Diversity in structure is the rule,

from all ages and species of regeneration to a variety of downed logs and snags.

**RECREATION AND VISUAL MANAGEMENT:** The potential for dispersed recreational opportunities seems low. The slopes are steep and available water is scarce. Poison oak is occasional to abundant, depending on the association.

# MAJOR PLANT SPECIES BY VEGETATION LAYER

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ABCO	white fir	7%	5	10	5	7.5	3.5	
CADE3	incense-cedar	23%	5	20	15	13.3	6.8	
PIJE	Jeffrey pine	3%	40	40	0	40.0	.0	
PILA	sugar pine	30%	2	20	18	10.4	5.8	
PIPO	ponderosa pine	26%	10	20	10	13.6	4.8	
PSME	Douglas-fir	96%	5	80	75	52.5	18.9	
THPL	western redcedar	3%	20	20	0	20.0	.0	
	TOTAL OVERSTORY	100%	10	90	80	63.3	18.6	
ABCO	—CONIFERS— white fir	46%	2	20	18	9.9	5.7	
CADE3	incense-cedar	61%	2	30	28	11.7	10.0	
PIJE	Jeffrey pine	3%	15	15	0	15.0	.0	
PILA	sugar pine	30%	1	8	7	3.1	2.5	
PSME	Douglas-fir	100%	5	90	85	30.4	18.6	
TABR	Pacific yew	3%	7	7	0	7.0	.0	
THPL	western redcedar	3%	2	2	0	2.0	.0	
TSHE	western hemlock	3%	1	1	0	1.0	.0	
	—HARDWOODS— vine maple	26%	5	80	75	26.4	33.5	
ACMA	big-leaf maple	26%	5	60	55	20.3	19.8	
ARME	Pacific madrone	46%	1	15	14	7.7	5.2	
CACH	golden chinquapin	53%	1	40	39	9.6	10.2	
QUGA	Oregon oak	7%	5	20	15	12.5	10.6	
QUKE	California black oak	11%	5	20	15	10.0	8.7	
	TOTAL UNDERSTORY	100%	23	125	102	67.5	26.6	
AMAL	western serviceberry	7%	3	10	7	6.5	4.9	
ARPA	greenleaf manzanita	3%	1	1	0	1.0	.0	
BENE	dwarf Oregongrape	73%	2	60	58	19.4	19.3	
BEPI	Piper's Oregongrape	23%	1	10	9	4.5	3.6	
CEIN	deerbrush	3%	1	1	0	1.0	.0	
CHME	little prince's-pine	11%	1	1	0	1.0	.0	
CHUM	common prince's-pine	26%	1	5	4	2.1	1.5	
CONU	Pacific dogwood	50%	2	30	28	7.8	8.0	
COCOC	California hazel	50%	1	25	24	5.8	6.3	
GASH	salal	57%	8	90	82	44.3	31.8	
HODI	creambush ocean-spray	61%	2	30	28	12.2	9.4	
LOCI	trumpet honeysuckle	11%	1	2	1	1.7	.6	
LOHI	hairy honeysuckle	19%	2	7	5	3.0	2.2	
RHPU	cascara	3%	3	3	0	3.0	.0	
RHMA	Pacific rhododendron	7%	5	8	3	6.5	2.1	
RHDI	poison oak	42%	2	70	68	14.7	20.7	
ROGY	baldhip rose	76%	1	20	19	4.3	4.9	
RUPA	thimbleberry	7%	1	3	2	2.0	1.4	
RUUR	Pacific blackberry	69%	1	15	14	4.4	3.9	
SALIX	willow spp.	3%	2	2	0	2.0	.0	
SYAL	common snowberry	3%	15	15	0	15.0	.0	
SYMO	creeping snowberry	53%	1	8	7	3.4	1.7	
VAME	thin-leaved huckleberry	3%	2	2	0	2.0	.0	
VAPA	red huckleberry	19%	1	5	4	3.0	1.6	
WHMO	whipplevine	73%	1	40	39	9.7	9.0	
	TOTAL SHRUB	100%	6	179	173	80.6	47.6	

MAJOR PLANT SPECIES BY VEGETATION LAYER (continued)

CODE	COMMON NAME	CONST	MIN	MAX	RANGE	MEAN	S.D.	REMARKS
ACMI	common yarrow	3%	1	1	0	1.0	.0	
ACTR	vanilla leaf	50%	1	40	39	8.8	11.5	
ACCO	Columbia monkshood	3%	1	1	0	1.0	.0	
ADBI	trail-plant, pathfinder	76%	1	10	9	2.8	2.9	
ANDE	threeleaf anemone	30%	1	5	4	1.6	1.4	
APAN	spreading dogbane	7%	1	2	1	1.5	.7	
ARMA3	bigleaf sandwort	26%	1	2	1	1.3	.5	
ARCO	heart-leaf arnica	3%	3	3	0	3.0	.0	
ARLA	mountain arnica	7%	1	3	2	2.0	1.4	
ASHA	marbled wild ginger	7%	1	2	1	1.5	.7	
ASTR	maidenhair spleenwort	3%	1	1	0	1.0	.0	
ASTER		3%	1	1	0	1.0	.0	
CATO	Tolmie's mariposa	7%	1	1	0	1.0	.0	
CAPR3	California harebell	19%	1	1	0	1.0	.0	
CASC2	rough harebell	57%	1	10	9	1.7	2.3	
CAAP2	pointed mariposa	3%	1	1	0	1.0	.0	
CIRSI		3%	1	1	0	1.0	.0	
CLUN	queen's cup	3%	1	1	0	1.0	.0	
COLA	cutleaf goldthread	7%	1	4	3	2.5	2.1	
COMA3	spotted coral-root	3%	1	1	0	1.0	.0	
COME	Pacific coral-root	7%	1	1	0	1.0	.0	
COST2	hooded coral-root	7%	1	1	0	1.0	.0	
CYGR	Pacific hound's-tongue	19%	1	1	0	1.0	.0	
DELPH		7%	2	3	1	2.5	.7	
DIHOO	Oregon fairybell	53%	1	2	1	1.4	.5	
EBAU	phantom-orchid	3%	1	1	0	1.0	.0	
EQUIS		3%	2	2	0	2.0	.0	
EQAR	common horsetail	3%	2	2	0	2.0	.0	
FRVEB	woods strawberry	38%	1	5	4	1.8	1.2	
GAAP	catchweed bedstraw	57%	1	7	6	1.5	1.6	
GAOR	Oregon bedstraw	7%	1	2	1	1.5	.7	
GATR	fragrant bedstraw	3%	1	1	0	1.0	.0	
GOOB	rattlesnake-plantain	42%	1	1	0	1.0	.0	
HAUN	Alaska bog-orchid	3%	1	1	0	1.0	.0	
HAL	white-flowered hawkweed	65%	1	15	14	2.3	3.4	
IRIS	iris spp.	7%	1	1	0	1.0	.0	
IRCH	slender-tubed iris	3%	1	1	0	1.0	.0	
IRTEK	Oregon iris	3%	1	1	0	1.0	.0	
LAPO	leafy peavine	23%	1	15	14	3.8	5.6	
LIGR	Gray's licorice-root	3%	15	15	0	15.0	.0	
LILU		3%	1	1	0	1.0	.0	
LIBOL	western twinflower	50%	1	10	9	3.8	2.7	
LOMAT		3%	2	2	0	2.0	.0	
LUPIN	lupine spp.	3%	2	2	0	2.0	.0	
MAMA	woodland tarweed	23%	1	2	1	1.2	.4	
MOSI	candyflower	3%	1	1	0	1.0	.0	
NEHE	small white nemophila	3%	1	1	0	1.0	.0	
OSCH	mountain sweet-root	38%	1	4	3	1.9	1.2	
PHAD	woodland phlox	11%	1	1	0	1.0	.0	
POMU	western sword-fern	73%	1	20	19	4.8	5.3	
PRVU	self-heal	7%	1	1	0	1.0	.0	
PSPH	California-tea	3%	3	3	0	3.0	.0	
PTAQ	bracken	61%	1	15	14	4.8	4.3	
PYAP	leafless pyrola	3%	1	1	0	1.0	.0	
PYPI	whitevein pyrola	11%	1	1	0	1.0	.0	
SADO	yerba buena	11%	1	4	3	2.3	1.5	
SMRA	w. stern false Solomon's-seal	23%	1	1	0	1.0	.0	
SMST	starry false Solomon's-seal	7%	1	1	0	1.0	.0	
SYRE	snow-queen	53%	1	7	6	2.2	1.8	
TRLA2	western starflower	73%	1	10	9	2.3	2.1	
TROV	white trillium	7%	1	1	0	1.0	.0	
VAHE	white inside-out-fir	38%	1	8	7	1.8	2.2	
VIAM	American vetch	26%	1	15	14	4.0	5.1	
VIAD	early blue violet	3%	1	1	0	1.0	.0	
VIGL	stream violet	26%	1	2	1	1.1	.4	

VIOR2	round-leaved violet	30%	1	2	1	1.5	.5	
XETE	common beargrass	23%	3	15	12	7.5	4.9	
	TOTAL HERB	100%	8	133	125	34.7	26.0	
BROMU	brome spp.	3%	1	1	0	1.0	.0	
BRPA	Pacific brome	46%	1	10	9	2.3	2.6	
BRVU	Columbia brome	7%	1	5	4	3.0	2.8	
CAREX	sedge spp.	11%	1	81	80	27.7	46.2	
CARO	Ross sedge	3%	1	1	0	1.0	.0	
CYEC	hedgehog dogtail	3%	2	2	0	2.0	.0	
ELGL	blue wildrye	23%	1	3	2	1.7	.8	
FESTU	fescue spp.	7%	1	1	0	1.0	.0	
FECA	California fescue	7%	3	3	0	3.0	.0	
FEOC	western fescue	23%	1	10	9	3.0	3.5	
FERU	red fescue	3%	4	4	0	4.0	.0	
MESU	Alaska oniongrass	3%	2	2	0	2.0	0	
POA		3%	1	1	0	1.0	0	
	TOTAL GRASS	100%	1	85	84	6.6	16.4	

### DOUGLAS-FIR AND OAK KEY

1a	Wedgeleaf ceanothus [CECU] present.	2
1b	Wedgeleaf ceanothus [CECU] absent.	3
2a	Douglas-fir [PSME] present.	PSME/CECU
2b	Douglas-fir [PSME] absent.	CECU/CYEC
3a	Oregon white oak [QUGA] present.	4
3b	Oregon white oak [QUGA] absent.	5
4a	Hedgehog dogtail [CYEC] present.	QUGA/FRVEB
4b	Hedgehog dogtail [CYEC] absent.	PSME-QUGA/RHDI
5a	Jeffrey pine [PIJE] present.	PSME-PIJE
5b	Jeffrey pine [PIJE] absent.	6
6a	Poison oak [RHDI] present.	7
6b	Poison oak [RHDI] absent.	8
7a	California black oak [QUKE] present.	PSME/RHDI/CYGR
7b	California black oak [QUKE] absent.	PSME/RHDI/PTAQ
8b	Salal [GASH] present.	PSME/GASH/POMU
8a	Salal [GASH] absent.	PSME/BENE/POMU

### DOUGLAS-FIR AND OAK ASSOCIATIONS

PSME/GASH/POMU pg. 302	Douglas-fir / Salal / Western sword-fern <i>Pseudotsuga menziesii</i> / <i>Gaultheria shallon</i> / <i>Polystichum munitum</i>
PSME/BENE/POMU pg. 307	Douglas-fir / Dwarf Oregongrape / Western sword-fern <i>Pseudotsuga menziesii</i> / <i>Berberis nervosa</i> / <i>Polystichum munitum</i>
PSME/RHDI/PTAQ pg. 311	Douglas-fir / Poison oak / Bracken <i>Pseudotsuga menziesii</i> / <i>Rhus diversiloba</i> / <i>Pteridium aquilinum</i>
PSME/RHDI/CYGR pg. 315	Douglas-fir / Poison oak / Pacific hound's-tongue <i>Pseudotsuga menziesii</i> / <i>Rhus diversiloba</i> / <i>Cynoglossum grande</i>
PSME-QUGA/RHDI pg. 318	Douglas-fir - Oregon oak / Poison oak <i>Pseudotsuga menziesii</i> - <i>Quercus garryana</i> / <i>Rhus diversiloba</i>
PSME-PIJE pg. 321	Douglas-fir - Jeffrey pine <i>Pseudotsuga menziesii</i> - <i>Pinus jefferyi</i>

DOUGLAS-FIR AND OAK ASSOCIATIONS (continued)

QUGA/FRVEB pg. 324	Oregon oak / Woods strawberry <i>Quercus garryana</i> / <i>Fragaria vesca bracteata</i>
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**DOUGLAS-FIR / SALAL / WESTERN SWORD-FERN**  
*Pseudotsuga menziesii* / *Gaultheria shallon* / *Polystichum munitum*  
**PSME/GASH/POMU**

**EXTENT:** **PSME/GASH/POMU** occurs on all districts of the Umpqua National Forest. Most sites are found on Tiller Ranger District. N = 12 plots.

**IDENTIFYING CHARACTERISTICS:** Pacific madrone, incense-cedar, and golden chinquapin may be present in the understory. However, Pacific madrone, incense-cedar, and golden chinquapin are rare in the understory in **PSME/BENE/POMU**, and salal and western twinflower are usually absent. The lack of poison oak differentiates **PSME/GASH/POMU** and **PSME/BENE/POMU** from the other **PSME** Associations.

**ABIOTIC ENVIRONMENT:** **PSME/GASH/POMU** is generally found on the upper third of the ridge, on flat to convex slopes, at the upper elevational range of the **PSME** Series. The south facing, steep slopes (50 percent) intercept twice the amount of direct solar radiation (about 15,000 calories in June) as do north facing, steep slopes, and temperatures build rapidly during the day. Convection moves a portion of the heat, but a large amount is stored in the soil, vegetation, and air. Conductive soils can carry much of the heat into the lower profile, away from the surface, particularly if they are saturated; but dry, granitic soils easily reach temperatures that destroy poorly insulated cambial tissue.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3000.0	551.0
Aspect (deg)	185.6	105.3
Slope (%)	50.7	21.1
Total soil depth (in)	37.1	14.1
Rooting depth (in)	44.8	9.5
Total basal area (ft <sup>2</sup> /ac)	250.0	74.6

**CLIMATE:** Precipitation is high for the **PSME** Series (an estimated 54 inches), but the majority falls as rain between October and April. Growing season precipitation usually does not extend the growing season much beyond what the soil reservoir provides. Humidity is usually low and transpiration rates high. Moisture is the most limiting factor affecting plant growth. High growing season tempera-

tures increase respiration rates and water requirements. Soil surface temperatures of 170 degrees F. are common on south facing slopes during the growing season.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.4	1.5
Maximum month temp (F)	82.5	2.2
Mean annual ppt (in)	60.0	9.2
Dry season ppt (in)	7.7	.9

**FOREST FLOOR:** Soils have developed from a variety of extrusive igneous parent materials. Total soil depth is about average for the **PSME** series (37 inches) with a slightly less than average cover of litter. Frequent low intensity fires may be responsible for eliminating some of the coarse litter (stems and branches). Fine litter is replaced on a shorter cycle and is usually present. Decomposition is likely limited by lack of moisture. However, when moisture levels are adequate, decomposition rates are probably rapid.

FOREST FLOOR	MEAN	S.D.
Litter (%)	83.2	21.2
Moss (%)	13.9	20.3
Bareground (%)	3.3	4.5
Gravel (%)	2.3	3.1
Rock (%)	2.2	2.8
Bedrock (%)	.7	1.6

**VEGETATION:** Douglas-fir and its common associate, sugar pine, dominate the tree overstory. Douglas-fir, Pacific madrone, incense-cedar, golden chinquapin, white fir, and sugar pine are present in the understory. Common shrubs are dwarf Oregon-grape, salal, whippoorwill, baldhip rose, and creambush ocean-spray, with sword-fern, pathfinder, western starflower, snow-queen, vanillaleaf, Oregon fairybell, and western twinflower as the common herbs. Early successional species include Douglas-fir, sugar pine, Pacific madrone, and incense-cedar.



Sugar pine and white fir are indicators of the better sites in the Association where higher stocking levels can be sustained. Ocean-spray and whipplevine occur on the driest and least productive sites.

**SILVICULTURE:** Douglas-fir, sugar pine, incense-cedar, ponderosa pine, white fir, madrone, golden chinquapin, and Pacific yew are all appropriate for reforestation. Douglas-fir, ponderosa pine, and sugar pine are the best adapted for planting after harvest. Sugar pine diameters often are much larger than adjacent trees of the same age. Ponderosa pine will do well if wet snow accumulation is not likely. Growth losses from breakage are significant. White fir would be appropriate for interplanting on sites where dwarf Oregongrape cover is over 20 percent, or in parts of the unit with such cover. Madrone and chinquapin will come in naturally on most disturbed sites. In fact, either may develop cover that will substantially reduce diameter growth of the coniferous crop. On the driest sites of the Association, early summer moisture stress will reduce survival rates; shelterwood or uneven-age silviculture may be appropriate. Productivity is at the high end of the series. Basal area averages 250 square feet, but may be as high as 420 square feet. High shrub cover (average is 97 percent) indicates the potential for competition and growth loss on crop trees. Average herb and grass cover are low, likely a result of shrub competition. Grass cover may increase dramatically following harvesting, particularly if shrub cover is reduced by half. There is an unusually high number of grass species associated with PSME/GASH/POMU.

**WATERSHED MANAGEMENT:** Precipitation averages about 60 inches, most falls as rain onto a 37 inch deep soil with a field capacity of about 5 inches. Soils are well to excessively drained with rapid to moderately rapid permeability. The risk of mass

wasting, surface erosion, and creating turbidity is moderate. Shrub cover is high and rooting depth is deep. Grasses protect the surface layers and all species are potentially usable for erosion control.

**FIRE MANAGEMENT:** Evidence of fire was found in 6 of the 12 plots sampled. Fire has played a major role in stand development in most cases, either in generation or altering composition. Sites generally are south facing, steep and subject to high radiation loads. Fuels dry quickly. Vertical distribution of fuels is continuous in many stands. Brush, lower limbs, and tolerant incense-cedar intermingle. Stand ages vary, but two general age classes are present. The first is about 160 years and the second is about 240 years old. Risk of fire in PSME/GASH/POMU is the lowest of the Series but still relatively high for Cascade associations.

**RANGE & WILDLIFE MANAGEMENT:** Grasses are present, but cover is low under established stands. The variety of bromes and fescues should increase as canopy density decreases. Shrub species are plentiful, providing browsers with a choice of evergreen and deciduous forage. Spring and early summer herbaceous cover averages about 35 percent cover. Thermal and hiding cover are spotty but generally available. Diversity in structure is the rule, from all ages and species of regeneration to a variety of downed logs and snags. Old hollow incense-cedar logs occasionally add variety to the forest floor.

**RECREATION & VISUAL MANAGEMENT:** Visually stands are typical forest: steep, sometimes brushy, with few, if any, openings. Soils generally are resilient and recover quickly if disturbed. Wildflowers are common in the spring. Violets, snow-queen, fairy-bells, twinflower, lilies, and several saprophytic species commonly liven the landscape.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	8%	5.0	.0	indicates the better sites in the association
CADE3	incense-cedar	25%	13.3	7.6	tolerates soil and climatic extremes
PILA	sugar pine	58%	9.0	4.7	early successional, indicates better sites
PIPO	ponderosa pine	8%	20.0	.0	good for reforestation in areas with light snow
PSME	Douglas-fir	100%	55.2	15.3	good for reforestation
THPL	western redcedar	8%	20.0	.0	in moister areas
	TOTAL OVERSTORY	100%	67.6	9.9	
	—CONIFERS—				
ABCO	white fir	66%	12.1	5.4	interplant on sites with BENE cover greater than 20%
CADE3	incense-cedar	66%	12.6	11.5	tolerates soil and climate extremes
PILA	sugar pine	58%	3.3	2.6	well adapted for planting after harvest
PSME	Douglas-fir	100%	26.7	13.2	well adapted for planting after harvest
TABR	Pacific yew	8%	7.0	0	sites with higher than average atmospheric moisture
THPL	western redcedar	8%	2.0	0	moist sites
	—HARDWOODS—				
ACCI	vine maple	41%	20.0	28.3	may be a vegetation management problem
ACMA	big-leaf maple	8%	15.0	0	may be a vegetation management problem
ARME	Pacific madrone	75%	8.0	5.9	comes in on disturbed sites
CACH	golden chinquapin	83%	7.3	5.9	comes in on disturbed, rocky sites
	TOTAL UNDERSTORY	100%	67.5	29.1	
ARPA	greenleaf manzanita	8%	1.0	.0	hot, dry sites
BENE	dwarf Oregongrape	91%	15.5	16.6	deep, fertile soils
BEPI	Piper's Oregongrape	25%	3.0	2.0	drier, rockier, less productive sites
CHME	little prince's-pine	16%	1.0	.0	
CHUM	common prince's-pine	25%	2.7	2.1	drier sites, cool to warm
CONU	Pacific dogwood	58%	3.9	2.3	provides deer browse
COCOC	California hazel	50%	3.8	2.7	provides deer browse
GASH	salal	100%	46.5	29.3	warmer, drier indicator, productive sites
HODI	creambush ocean-spray	75%	14.0	11.0	warm, dry sites, often rocky, shallow soil
LOCI	trumpet honeysuckle	16%	1.5	.7	
LOHI	hairy honeysuckle	8%	2.0	0	hot, dry sites, often rocky, well-drained soils
RHMA	Pacific rhododendron	16%	6.5	2.1	nice spring flowers
ROGY	baldhip rose	83%	2.9	1.9	hips contain high levels of vitamin
RUPA	thimbleberry	16%	2.0	1.4	provides food for birds
RUUR	Pacific blackberry	66%	5.1	4.5	excellent deer browse
SALIX	willow spp.	8%	2.0	.0	can be competitive with young conifers
SYMO	creeping snowberry	58%	3.6	2.2	indicates disturbance
VAPA	red huckleberry	41%	3.0	1.6	provides food for birds
WHMO	whipplevine	100%	8.9	6.1	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	97.1	31.2	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanillaleaf	66%	5.6	6.3	moist sites, deep, well-drained soils
ADBI	trail-plant, pathfinder	83%	3.2	3.2	common
ANDE	threelaf anemone	33%	2.3	1.9	common, mesic sites
ARMA3	bigleaf sandwort	8%	1.0	.0	
ARLA	mountain arnica	16%	2.0	1.4	cool, moist sites
ASHA	marbled wild ginger	16%	1.5	.7	
ASTR	maidenhair spleenwort	8%	1.0	.0	moist site indicator
CATO	Tolmie's mariposa	8%	1.0	.0	
CAPR3	California harebell	16%	1.0	.0	
CASC2	rough harebell	50%	1.3	.5	
CLUN	queen's cup	8%	1.0	0	cool, moist site indicator
COLA	cutleaf goldthread	16%	2.5	2.1	
COME	Pacific coral-root	8%	1.0	0	
COST2	hooded coral-root	8%	1.0	.0	
DIHOO	Oregon fairybell	66%	1.5	.5	
EBAU	phantom-orchid	8%	1.0	.0	
EQUIS		8%	2.0	0	moist to wet sites
EQAR	common horsetail	8%	2.0	.0	moist to wet sites
FRVEB	woods strawberry	16%	1.5	.7	excellent for berry picking
GAAP	catchweed bedstraw	33%	1.0	0	
GAOR	Oregon bedstraw	8%	2.0	.0	
GATR	fragrant bedstraw	8%	1.0	.0	
GOOB	rattlesnake-plantain	50%	1.0	.0	
HIAL	white-flowered hawkweed	58%	1.7	1.1	warm, dry site indicator
IRIS	iris spp.	8%	1.0	.0	
LAPO	leafy peavine	25%	2.0	1.7	nitrogen fixer
LIGR	Gray's licorice-root	8%	15.0	0	
LILIU		8%	1.0	.0	
LIBOL	western twinflower	66%	4.8	3.0	common
MAMA	woodland tarweed	16%	1.5	.7	hot, dry sites
MOSI	candyflower	8%	1.0	.0	moist site indicator
OSCH	mountain sweet-root	8%	3.0	.0	
PHAD	woodland phlox	8%	1.0	.0	
POMU	western sword-fern	100%	3.6	4.1	productive sites
PRVU	self-heal	8%	1.0	.0	
PTAQ	bracken	58%	7.0	5.9	aggressive competitor after harvest
PYAP	leafless pyrola	8%	1.0	0	
PYPI	whitevein pyrola	16%	1.0	.0	
SADO	yerba buena	16%	2.5	2.1	
SMRA	western false Solomon's-seal	33%	1.0	0	
SYRE	snow-queen	75%	1.7	1.3	
TRLA2	western starflower	100%	2.1	1.0	moderately dry to moist sites, disturbed sites
VAHE	white inside-out-flr	50%	2.3	2.8	part of the mesic middle indicators
VIAM	American vetch	25%	1.0	0	possible nitrogen fixer
VIAD	early blue violet	8%	1.0	0	moist site indicator
VIGL	stream violet	16%	1.5	.7	moist site indicator
VIOR2	round-leaved violet	41%	1.6	.5	moist site indicator
XETE	common beargrass	25%	5.7	3.8	dry site indicator
	TOTAL HERB	100%	35.2	17.4	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BRPA	Pacific brome	50%	1.5	.8	
BRVU	Columbia brome	8%	1.0	.0	
CAREX	sedge spp.	8%	1.0	.0	
CARO	Ross sedge	8%	1.0	.0	
ELGL	blue wildrye	16%	2.0	1.4	
FESTU	fescue spp.	16%	1.0	.0	
FECA	California fescue	8%	3.0	.0	
FEOC	western fescue	16%	1.0	.0	
MESU	Alaska oniongrass	8%	2.0	.0	
	TOTAL GRASS	100%	2.7	2.1	

DOUGLAS-FIR / DWARF OREGONGRAPE/ WESTERN SWORD-FERN  
*Pseudotsuga menziesii* / *Berberis nervosa* / *Polystichum munitum*  
**PSME/BENE/POMU**

**EXTENT:** PSME/BENE/POMU occurs on the North Umpqua Ranger District. It may also occur on the Cottage Grove and lower reaches of the Diamond Lake Ranger Districts. N = 3 plots.

**IDENTIFYING CHARACTERISTICS:** PSME/BENE/POMU can be best identified by what species are absent. In the understory, Pacific madrone, incense-cedar, and golden chinquapin are rare, and salal and western twinflower are usually absent; whereas, in PSME/GASH/POMU they are usually present. The lack of poison oak differentiates PSME/BENE/POMU and PSME/GASH/POMU from the other PSME Associations.

**ABIOTIC ENVIRONMENT:** Deep soils (50 inches) have developed from andesite and basalt. Organic matter content and litter are slightly lower than average for Cascade associations. Low levels may result from a higher fire frequency or lower litter production. Slopes are steep (59 percent average) and litter may slowly creep downslope. PSME/BENE/POMU is found on the upper third of the slope with flat to convex microtopography. The slopes are some of the steeper of the PSME Series and are at the upper end of the elevational range.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3203.0	803.0
Aspect (deg)	169.5	74.2
Slope (%)	59.0	1.7
Total soil depth (in)	50.0	.0
Rooting depth (in)	50.0	.0
Total basal area (ft <sup>2</sup> /ac)	286.7	41.6

**CLIMATE:** Precipitation is calculated to be approximately 70 inches. It is more likely to be near 60 inches. In either case, rainfall is high for the Series. Snow accumulation and summer rainfall are low, consequently moisture stress is usually common. Since the average site is on or near the ridgetop, they are exposed to wind and humidity is low. Mean and maximum temperatures are about 2 degrees F. higher than the Cascade average (approximately 45 and 79). Moisture stress limits biomass production,

but high soil surface temperatures can kill young germinants.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.1	2.0
Maximum month temp (F)	81.7	3.1
Mean annual ppt (in)	70.0	0
Dry season ppt (in)	9.0	0

**FOREST FLOOR:** Herbs and litter totally cover the ground. Exposed soil accounts for less than 2 percent of most stands. Moss, however, is uncommon or absent, an indication that the litter and surface are dry. The Series averages approximately 14 percent moss cover as does the average Cascade stand.

FOREST FLOOR	MEAN	S.D.
Litter (%)	88.7	8.1
Moss (%)	1.0	0
Bareground (%)	2.0	2.6
Gravel (%)	2.0	2.6
Rock (%)	.7	.6
Bedrock (%)	.3	.6

**VEGETATION:** Tree composition includes Douglas-fir as the dominant with an understory of Douglas-fir and big-leaf maple. White fir will continue to be part of the stand, but will become less important, with increased natural or artificial disturbance. It and vine maple indicate the cooler sites within a stand. Shrubs include dwarf Oregongrape, Pacific blackberry, Pacific dogwood, creambush ocean-spray, and whipplevine. Oregongrape and Pacific dogwood will increase in late seral stages. Blackberry and creambush ocean-spray are adapted to early successional stages. Creambush ocean-spray indicates dry, warm local conditions. Herbs are pathfinder, Scouler's harebell, catchweed bedstraw, western swordfern, and round-leaved violet. The imbricated variety of western swordfern usually indicates dry sites unlike the common variety (POMUM).

**SILVICULTURE:** Douglas-fir is appropriate regeneration for all sites. White fir and western hemlock are only appropriate on cooler sites, such as riparian areas, higher elevations, or northeast facing slopes. Douglas-fir naturals will germinate; however, due to the midsummer moisture stress, establishment can be limited. In areas with western hemlock seed rain is periodically high, but few germinants survive. Biomass production is high. All layers, overstory, understory, shrubs, and herbs, produce well and covers are high. Competition from grass and shrubs with crop trees will be high, particularly creambush ocean-spray.

**WATERSHED MANAGEMENT:** Precipitation (60-65 inches) falls mainly between October and April in the form of rain, with less than 7 inches falling between May and August. Soils are well to excessively drained, with rapid to moderate permeability (Umpqua Soil Resource Inventory, Mapping Unit 51). Surface erosion potential is moderate. susceptibility to mass wasting (debris slides) with timber removal or road construction is moderate. Susceptibility to compaction and puddling is also moderate. Soils are well protected with the high covers of

herbs and grasses. Disturbed areas can be revegetated with a variety of natural grasses.

**FIRE MANAGEMENT:** Wind and low humidity are common to the upper ridgetop positions of **PSME/BENE/POMU**. Combined with the hot and dry late growing season conditions, fuel would be dry most years. Light flashy fuels are abundant on the forest floor, as is the cover of shrubs. The probability of fire increases rapidly with stand age. Foot travel is difficult, the terrain is steep and dissected. All plots had evidence of past fire. **PSME/BENE/POMU** has a profile indicating high frequency, low intensity fire regime.

**RANGE & WILDLIFE MANAGEMENT:** Spring forbs are abundant, winter browse is available, and cover, both thermal and hiding, is common. Although forest floor structure is not complex, the tall and short life form of the shrubs provide avian habitat.

**RECREATION & VISUAL MANAGEMENT:** There is nothing inviting about **PSME/BENE/POMU**. The terrain is steep, the climate is hot during the summer, it has no outstanding visual values, it is usually far from water, and it can be very brushy. However, it is one of the closest associations to Disneyland.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PSME	Douglas-fir	100%	66.7	11.5	warmer site indicator
	TOTAL OVERSTORY	100%	66.7	11.5	
ABCO	—CONIFERS—				appropriate for regeneration only on cooler sites
PSME	white fir	33%	5.0	.0	
TSHE	Douglas-fir	100%	33.3	23.1	
	western hemlock	33%	1.0	.0	appropriate for regeneration only on cooler sites
	—HARDWOODS—				
ACCI	vine maple	33%	80.0	.0	will compete with young conifers
ACMA	big-leaf maple	66%	45.0	21.2	severe competitor with young conifers
	TOTAL UNDERSTORY	100%	92.0	12.1	
BENE	dwarf Oregongrape	100%	31.7	24.7	deep, fertile soils
CHME	little prince's-pine	33%	1.0	.0	
CHUM	common prince's-pine	33%	1.0	0	drier sites
CONU	Pacific dogwood	66%	22.5	10.6	provides deer browse
COCOC	California hazel	33%	10.0	.0	provides deer browse
HODI	creambush ocean-spray	66%	2.5	.7	provides deer browse
ROGY	baldhip rose	66%	8.0	9.9	hips contain high levels of vitamin C
RUUR	Pacific blackberry	100%	2.3	1.5	excellent deer browse
SYMO	creeping snowberry	33%	1.0	.0	disturbance indicator
WHMO	whipplevine	66%	6.5	2.1	warm, dry sites at low elevations, often rocky
	TOTAL SHRUB	100%	64.7	33.2	
ACTR	vanillaleaf	66%	20.5	27.6	moist sites, deep, well-drained soils
ADBI	trail-plant, pathfinder	100%	4.0	5.2	common
ANDE	threeleaf anemone	66%	1.0	0	common, mesic sites
ARMA3	bigleaf sandwort	33%	1.0	.0	
CASC2	rough harebell	100%	4.0	5.2	
COMA3	spotted coral-root	33%	1.0	.0	
COME	Pacific coral-root	33%	1.0	.0	
COST2	hooded coral-root	33%	1.0	.0	
DIHOO	Oregon fairybell	66%	1.0	.0	
FRVEB	woods strawberry	33%	5.0	.0	good berries
GAAP	catchweed bedstraw	100%	3.3	3.2	
GAOR	Oregon bedstraw	33%	1.0	0	
GOOB	rattlesnake-plantain	66%	1.0	0	
HAL	white-flowered hawkweed	66%	8.0	9.9	warm, dry site indicator
LAPO	leafy peavine	33%	15.0	.0	nitrogen fixer
OSCH	mountain sweet-root	33%	1.0	.0	
PHAD	woodland phlox	33%	1.0	.0	
POMU	western sword-fern	100%	8.7	9.8	productive sites
PTAQ	bracken	66%	3.0	0	aggressive competitor after harvest
PYPI	whitevein pyrola	33%	1.0	0	
SMRA	western false Solomon's-seal	33%	1.0	0	
SMST	starry false Solomon's-seal	33%	1.0	0	
SYRE	snow-queen	33%	3.0	0	
TRLA2	western starflower	66%	5.5	6.4	moderately dry to moist sites, disturbed sites
TROV	white trillium	66%	1.0	0	part of the middle mesic indicators
VAHE	white inside-out-flr	33%	1.0	0	part of the middle mesic indicators
VIAM	American vetch	33%	1.0	0	possible nitrogen fixer
VIGL	stream violet	66%	1.0	0	moist sites
VIOR2	round-leaved violet	100%	1.3	6	moist sites
	TOTAL HERB	100%	61.0	62.6	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BRPA	Pacific brome	33%	1.0	0	
FEOC	western fescue	66%	2.5	.7	
	TOTAL GRASS	100%	2.0	1.0	



**DOUGLAS-FIR / POISON OAK / BRACKEN**  
*Pseudotsuga menziesii* / *Rhus diversiloba* / *Pteridium aquilinum*  
**PSME/RHDI/PTAQ**

**EXTENT:** PSME/RHDI/PTAQ occurs on the Tiller Ranger District. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** Poison oak, dwarf Oregongrape, and salal (occasionally absent) distinguish PSME/RHDI/PTAQ from other PSME Associations.

**ABIOTIC ENVIRONMENT:** Soils, developed from pumice and granite, are 35 inches deep, the average Series depth. PSME/RHDI/PTAQ is found on the upper third of slopes with convex microtopography. Slopes, 42 percent, usually face south at the lower elevational range of the Series.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2238.0	202.0
Aspect (deg)	179.3	61.6
Slope (%)	35.8	25.7
Total soil depth (in)	37.7	11.2
Rooting depth (in)	42.2	12.4
Total basal area (ft <sup>2</sup> /ac)	212.0	92.3

**CLIMATE:** The temperature regime is hot and dry. PSME/RHDI/PTAQ tends to occur on south aspects at relatively low elevations (2200 feet). Maximum temperatures often exceed 90 degrees F. in July and August. Convective and radiative heat stress plant cooling systems which deplete soil moisture as early as May. Transpirational demand can be as high as 14 inches per month. With dry season input averaging less than 7 inches, moisture stress and water deficit almost certainly occur every summer. Biomass productivity in PSME/RHDI/PTAQ is limited by water.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	49.5	.5
Maximum month temp (F)	85.6	.7
Mean annual ppt (in)	50.0	7.1
Dry season ppt (in)	6.4	.9

**FOREST FLOOR:** The soil surface is covered with fine litter and twice the amount of moss found on the

average Cascade site. Moss indicates warm, moist conditions, which seems inconsistent with the macroclimate for the Association. Moss is active when resources are available, and temperatures are not limiting. The soil surface must occasionally be both warm and moist to have developed such an extensive layer of moss. Duff depth is likely to be low; frequent, but low intensity burning reduces the amounts. Decomposition rates may also be high as indicated by the high amount of moss, a second factor. Physical characteristics (rock, gravel, bedrock) are slightly less than the Cascade average.

FOREST FLOOR	MEAN	S.D.
Litter (%)	97.6	4.3
Moss (%)	28.0	18.9
Bareground (%)	2.6	3.7
Gravel (%)	.4	.9
Rock (%)	.2	.4
Bedrock (%)	.0	.0

**VEGETATION:** Douglas-fir is the most common dominant in both the regeneration and overstory tree layers. It can be a significant component in the early stages of succession or dominate in old-growth stands. Incense-cedar and sugar pine are its most common associates. Sugar pine occurs on the best sites and incense-cedar is non-specific; it can grow anywhere. Big-leaf maple grows on humid sites, vine maple occurs on the coolest sites, and golden chinquapin indicates the driest, rocky sites. The shrub layer supports conflicting indicators. Dwarf Oregongrape usually indicates a moderate climate, while poison oak indicates either hot, dry or recently disturbed conditions. Considering the high moss cover, the frequency of disturbance, and the soil depth, it is highly likely that dwarf Oregongrape is the accurate indicator. The site is relatively moderate for the Series. Pacific dogwood, California hazel, and salal would be corresponding indicators, if present. Creambush ocean-spray increases in cover with increasing moisture stress. Herbs include western twinflower, bracken, western swordfern, and common beargrass.

clude western twinflower, bracken, western sword-fern, and common beargrass.

**SILVICULTURE:** Douglas-fir and incense-cedar are well adapted to PSME/RHDI/PTAQ sites. Survival and growth rates will be high throughout the Association. Relying on natural regeneration is risky in an even-aged management format. Reducing high transpirational demand will increase survival. Sugar pine will grow best on moderate sites where moisture stress is low. Listed in order of decreasing moisture needs are big leaf maple, madrone, and golden chinquapin. Enhancement is not usually a concern with this trio. Quite the opposite, all will prolifically sprout and readily compete for moisture and elements earmarked for the crop trees. A preventative control strategy, such as maintaining a closed canopy of conifers until harvest, may be enough to prevent them from becoming unacceptably competitive. The Douglas-fir Series does not readily self-thin. Controlling stocking levels is more important here than with other series, if a certain volume and diameter are expected at rotation age.

**WATERSHED MANAGEMENT:** Annual average precipitation is about 50 inches, approximately 80 percent is rain. Summer rainfall is about 10 percent of total. Snow accumulation is rare. Soils are porous, excessively drained, with a low field capacity (estimated as less than 4 inches). The potential for mass wasting and surface erosion is high. Since most sites are granitic, protection of the soil surface will reduce the risk of sediment production significantly. Beargrass, Pacific brome, and basin wild rye could be planted or seeded to control erosion.

**FIRE MANAGEMENT:** Three of the four PSME/RHDI/PTAQ plots sampled had been burned by low intensity fire. Fire season weather is hot, dry, and

subject to convective winds, as most sites are at upper slope, south aspect, exposed positions. Stems, branches, needles, and leaves are produced at moderate rates, but decomposition rates are probably high. Historically frequent low intensity burns have kept fuel loads low. Vertical distribution of fuels (shrubs and understory trees and lower branches) is likely to be discontinuous. Overstory dominants are intolerant of shade. Thus, lower branches naturally prune, sporadic regeneration does not thrive, and shrubs remain short. As the stand reaches an average diameter of about 12 inches, light underburning could be introduced without damaging the crop trees. Douglas-fir seems to be resistant after it reaches 9-12 inches in diameter.

**RANGE & WILDLIFE MANAGEMENT:** Forbs and grasses produce about 37 percent cover, but water sources are scarce. Because the sites warm early in spring, forbs and grass develop early. This, coupled with the high cover of shrubs, many of them potential browse species, may result in high ungulate use. Although hiding cover may be afforded by shrubs, thermal cover is likely to be localized in pockets produced by gap-phase regeneration. Incense-cedar provides long-lasting snags and downed logs; it is an important stand component providing diversity in species and structure.

**RECREATION & VISUAL MANAGEMENT:** Hot, dry, steep, brushy, monotonous, poison oak infested sites are characteristic of PSME/RHDI/PTAQ. Mosquitoes are the most interesting wildlife in the spring, but bees and hornets provide summer diversity. There are no known rare plants, however, some are poisonous.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
CADE3	incense-cedar	40%	10.0	7.1	fire resistant somewhat drought tolerant previous fire history
PILA	sugar pine	20%	20.0	.0	
PIPO	ponderosa pine	20%	10.0	.0	
PSME	Douglas-fir	100%	45.0	21.2	
	TOTAL OVERSTORY	100%	55.0	24.0	
ABCO	—CONIFERS— white fir	20%	5.0	.0	relatively cooler, wetter conditions adds to species diversity
CADE3	incense-cedar	80%	6.5	4.7	
PSME	Douglas-fir	100%	48.0	26.8	
ACCI	—HARDWOODS— vine maple	20%	5.0	.0	moist, well drained soils evidence of recent fire history shallow, rocky soils
ACMA	big-leaf maple	60%	5.7	1.2	
ARME	Pacific madrone	40%	7.5	3.5	
CACH	golden chinquapin	80%	15.5	16.8	
	TOTAL UNDERSTORY	100%	74.0	21.4	
AMAL	western serviceberry	20%	10.0	.0	deep, fertile soils drier, rockier, less productive sites than where BENE occurs
BENE	dwarf Oregongrape	80%	25.0	24.2	
BEPI	Piper's Oregongrape	20%	10.0	.0	
CHUM	common prince's-pine	60%	2.0	1.0	low elevations on warm sites in well-drained soils warm and dry, well-drained soils warm to dry sites, often rocky, shallow soils hot, dry conditions hot, dry conditions hot, dry sites with well-drained soils
CONU	Pacific dogwood	80%	7.3	5.4	
COCOC	California hazel	80%	9.3	10.5	
GASH	salal	60%	35.3	47.3	
HODI	creambush ocean-spray	80%	13.5	6.9	
LOCI	trumpet honeysuckle	20%	2.0	.0	
LOHI	hairy honeysuckle	40%	2.0	.0	
RHDI	poison oak	100%	16.6	29.9	
ROGY	baldhip rose	100%	7.2	7.3	
RUUR	Pacific blackberry	80%	4.8	3.8	
SYMO	creeping snowberry	80%	3.8	5	
WHMO	whipplevine	100%	12.8	15.5	
	TOTAL SHRUB	100%	115.0	60.4	

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ACTR	vanilla leaf	60%	9.7	9.6	moist sites, usually on deep, well-drained soil
ADBI	trail-plant, pathfinder	60%	2.0	.0	
ANDE	threeleaf anemone	40%	1.0	.0	wet, cool sites
ARMA3	bigleaf sandwort	40%	1.5	.7	
ARCO	heart-leaf arnica	20%	3.0	.0	
CAPR3	California harebell	40%	1.0	.0	
CASC2	rough harebell	80%	1.0	.0	
CYGR	Pacific hound's-tongue	20%	1.0	.0	dry sites with shallow soils
DIHOO	Oregon fairybell	80%	1.5	.6	mid to late successional
FRVEB	woods strawberry	20%	2.0	.0	generally warm sites in openings or forests
GAAP	catchweed bedstraw	80%	1.0	.0	
HAL	white-flowered hawkweed	60%	1.3	.6	
LAPO	leafy peavine	40%	1.0	.0	
LIBOL	western twinflower	100%	2.2	.8	abundance indicates relatively little soil drought
LOMAT		20%	2.0	.0	
MAMA	woodland tarweed	40%	1.0	.0	hot, dry and disturbed sites
OSCH	mountain sweet-root	40%	1.0	.0	
PHAD	woodland phlox	20%	1.0	.0	
POMU	western sword-fern	80%	5.5	4.8	generally productive sites
PRVU	self-heal	20%	1.0	.0	
PTAQ	bracken	100%	2.8	1.3	often invades after heavy disturbance
SMRA	western false Solomon's-seal	20%	1.0	.0	
SMST	starry false Solomon's-seal	20%	1.0	.0	
SYRE	snow-queen	40%	4.0	4.2	
TRLA2	western starflower	60%	1.3	.6	
VAHE	white inside-out-flr	40%	1.0	.0	
VIAM	American vetch	20%	15.0	.0	
VIGL	stream violet	60%	1.0	.0	
XETE	common beargrass	60%	9.3	6.0	cold, dry to moist sites
	TOTAL HERB	100%	37.8	20.2	
BRPA	Pacific brome	40%	1.5	.7	
CYEC	hedgehog dogtail	20%	2.0	.0	
ELGL	blue wildrye	60%	1.3	.6	
	TOTAL GRASS	100%	2.2	1.3	

**DOUGLAS-FIR / POISON OAK / PACIFIC HOUND'S-TONGUE**  
*Pseudotsuga menziesii* / *Rhus diversiloba* / *Cynoglossum grande*  
**PSME/RHDI/CYGR**

**EXTENT:** PSME/RHDI/CYGR has only been found on the Ashland Ranger District of the Rogue River National Forest. It may occur on the drier sites of the Butte Falls Ranger District. N = 3 plots.

**IDENTIFYING CHARACTERISTICS:** Douglas-fir and ponderosa pine in the overstory and Douglas-fir in the understory, combined with the presence of poison oak and Pacific hound's-tongue, characterizes PSME/RHDI/CYGR. The absence of salal, dwarf Oregongrape, western sword-fern, and bracken distinguishes it from PSME/GASH/POMU, PSME/BENE/POMU and PSME/RHDI/PTAQ. The lack of Oregon oak and hedgehog dogtail distinguishes it from the PSME-QUGA/RHDI, PSME-PIJE, PSME/CECU, and the QUERCUS Series.

**ABIOTIC ENVIRONMENT:** Soils have developed from andesite and basalt, and depth is slightly above average for the Series; but moisture stress limits biomass production. Surface rock averages 4 percent. PSME/RHDI/CYGR is found from the lower to upper third of the slopes, with microtopography ranging from flat to undulating. Slopes are slightly below the Series average. Aspects usually face southwest, and rainfall is estimated as lowest for the Series; although it is found at the highest elevations. PSME/RHDI/CYGR is characteristically found on the west side of the Dead Indian Plateau adjacent to the California black oak and grass openings.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3503.0	507.0
Aspect (deg)	238.9	16.5
Slope (%)	37.3	16.0
Total soil depth (in)	43.2	11.8
Rooting depth (in)	46.5	6.1
Total basal area (ft <sup>2</sup> /ac)	210.0	42.4

**CLIMATE:** Estimated average annual rainfall is 37 inches. Summer rain is rare and the estimates of dry season precipitation are likely optimistic. PSME/RHDI/CYGR's western position often misses rain associated with summer thundershowers. It is also associated with convective heat from the Rogue River valley. The climate is hot and dry.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	46.3	1.4
Maximum month temp (F)	80.5	2.1
Mean annual ppt (in)	36.7	2.9
Dry season ppt (in)	6.0	.0

**FOREST FLOOR:** The forest floor dries early in the spring. Moss, an indicator of moist soil surface conditions, averages 2 percent, while the Cascade average is about 15 percent. Litter amounts are about average. Although litter is produced at a lower rate than most associations, its decomposition is slowed by lack of water. Rates of nutrient cycling are also likely to be limited by moisture stress.

FOREST FLOOR	MEAN	S.D.
Litter (%)	93.0	2.6
Moss (%)	2.3	2.3
Bareground (%)	2.0	2.6
Gravel (%)	.7	.6
Rock (%)	3.7	3.8
Bedrock (%)	.0	.0

**VEGETATION:** Stands are young (about 80 years) with older components that survived the last fire. Openings that are naturally regenerating support white fir under the heaviest canopies and/or Douglas-fir in the larger openings. In the long run, Douglas-fir is expected to dominate; however, frequent fire has eliminated reference stands, clouding our crystal ball. Big-leaf maple indicates the moist sites, California black oak indicates the driest sites, and Pacific madrone is intermediate and also indicates recent disturbance. Thin-leaved huckleberry indicates the coldest sites, and is seemingly out of place associated with the PSME Series. Overstory, understory tree, shrub, and herb cover generally is sparse.

**SILVICULTURE:** Douglas-fir, California black oak, and incense-cedar are the most appropriate species for regeneration. White fir, big-leaf maple, and madrone may also be used. White fir and big-leaf maple are appropriate only for moist sites or

microsite planting. Madrone does not need encouragement, it sprouts prolifically. Natural regeneration potential depends on the harvest and site preparation method used as well as the site location. Generally natural regeneration potential is highest where moist site indicator cover is abundant, but generally is low on all associations in the Series. California hazel, creambush ocean-spray, and big-leaf maple, are moderately competitive. Maximizing crop tree growth would require some degree of controlling dominance. Grasses may also interfere with crop tree establishment and growth. Harvest designs that prevent or reduce moisture loss and decrease leaf temperature will be the most successful. Productivity is moderate, and marginal at the extreme. Thinning, either precommercial or commercial, is likely to be necessary to maintain acceptable growth rates, however, operational problems such as sensitive soils and steep slopes may limit economic viability. Cool burns, rather than mechanical site preparation, would better serve long-term site productivity.

**WATERSHED MANAGEMENT:** Mid summer rainfall is rare; precipitation falls mainly in the form of rain between October and April. Occasional storms stockpile winter snow which melts by early spring. Infiltration rates are high and the soils are well drained. Stability rates moderate, with moderate to high soil erosion potential. Potential sediment yield is also moderate. Recovery of vegetation following disturbance is slow. Since moisture limits survival, drought tolerant species such as ponderosa pine, incense-cedar, California black oak, creambush ocean-spray, slender-tube iris, and American vetch should be used.

**FIRE MANAGEMENT:** Fire has played a major role in shaping the structure and forming the composition of stands in **PSME/RHDI/CYGR**. Low intensity fire is a frequent occurrence (possibly a 30-60 year fire free period). The aspect, slope, and exposure to wind accelerate fuel drying, although fuel accumulation, related to site productivity, is relatively slow. Decomposition, due to the lack of moisture, is also slow. Snags and down logs are rare, many have been consumed by repeated fire, and overall fuel loadings tend to be low. Understory trees and shrubs (total shrub cover averages 99 percent) provide a moderately continuous fuel ladder.

**RANGE & WILDLIFE MANAGEMENT:** Deer and elk use tends to be in spring. Winter range is usually lower, and forage develops somewhat later than prime winter range. Grass cover is low, but herb cover averages 35 percent, and hazel and poison oak are good browse. Together they average 14 percent cover. Habitat for birds and small mammals is about average or slightly lower. Snags and down logs are not abundant (approximately 2 to 3 per acre). There is no consistent relationship with streams or available water. The potential for domestic livestock grazing is low.

**RECREATION & VISUAL MANAGEMENT:** The potential for dispersed recreational opportunities seems low. There are no outstanding or even mildly interesting characteristics. Most forest visitors would be passing through rather than staying in the area. Attractions such as camping spots with a view, water, or open, level, topography are lacking. Poison oak is not common nor obvious, but hidden enough to be insidious. It's a fine place for wood ticks.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
CADE3 PIPO PSME	incense-cedar ponderosa pine Douglas-fir TOTAL OVERSTORY	33% 100% 66% 100%	20.0 10.0 45.0 46.7	.0 .0 14.1 31.8	fire resistant drought tolerant
ABCO CADE3 PSME  ACMA ARME QUKE	---CONIFERS--- white fir incense-cedar Douglas-fir ---HARDWOODS--- big-leaf maple Pacific madrone California black oak TOTAL UNDERSTORY	33% 66% 100%  33% 33% 100% 100%	2.0 22.5 30.0  20.0 5.0 10.0 64.0	.0 10.6 5.0  .0 .0 8.7 21.6	moist sites fire resistant  moist sites intermediate sites with recent fire history driest sites
BENE COCOC HODI RHPU RHDI RUUR SYAL SYMO VAME	dwarf Oregongrape California hazel creambush ocean-spray cascara poison oak Pacific blackberry common snowberry creeping snowberry thin-leaved huckleberry TOTAL SHRUB	33% 33% 33% 33% 100% 33% 33% 66% 33% 100%	3.0 2.0 10.0 3.0 7.3 2.0 15.0 3.0 2.0 21.7	.0 .0 .0 .0 4.5 .0 .0 .0 .0 17.8	moderately competitive drought tolerant moist sites hot, dry sites  warm, dry slopes coldest sites
ACCO ADBI APAN ARMA3 CATO CASC2 CYGR DELPH FRVEB GAAP GOOB HAUN HIAL IRIS IRTEK NEHE OSCH SYRE TRLA2 VAHE VIAM	Columbia monkshood trail-plant, pathfinder spreading dogbane bigleaf sandwort Tolmie's mariposa rough harebell Pacific hound's-tongue  woods strawberry catchweed bedstraw rattlesnake-plantain Alaska bog-orchid white-flowered hawkweed iris spp. Oregon iris small white nemophila mountain sweet-root snow-queen western starflower white inside-out-flr American vetch TOTAL HERB	33% 66% 33% 100% 33% 66% 100% 66% 100% 66% 33% 33% 66% 66% 33% 33% 100% 33% 33% 66% 33% 66% 100%	1.0 1.5 1.0 1.3 1.0 1.0 1.0 2.5 1.7 1.0 1.0 1.0 1.5 1.0 1.0 1.0 2.3 3.0 1.5 1.0 4.5 19.3	.0 .7 .0 .6 0 .0 .0 .7 .6 0 0 .0 .7 .0 .0 .0 1.2 .0 .7 .0 .7 9.1	dry sites dry sites  generally warm sites in openings or forests
BRPA BRVU CAREX FECA FEOC	Pacific brome Columbia brome sedge spp. California fescue western fescue TOTAL GRASS	66% 33% 33% 33% 33% 100%	6.5 5.0 1.0 3.0 10.0 10.7	4.9 0 .0 .0 .0 5.9	

**DOUGLAS-FIR - OREGON OAK / POISON OAK**  
*Pseudotsuga menziesii* - *Quercus garryana* / *Rhus diversiloba*  
**PSME-QUGA/RHDI**

**EXTENT:** **PSME-QUGA/RHDI** occurs on the Tiller Ranger District. It may possibly occur on the North Umpqua Ranger District where soils are extremely shallow, on outcrops of the Umpqua Formation or on soils with a high clay content. N = 2 plots.

**IDENTIFYING CHARACTERISTICS:** Douglas-fir in the overstory, combined with Douglas-fir and Oregon white oak in the understory distinguishes **PSME-QUGA/RHDI** from the other **PSME** and **QUERCUS** Associations of the Series.

**ABIOTIC ENVIRONMENT:** **PSME-QUGA/RHDI** is found on the upper third of the slope. Microtopography is flat (neither concave or convex) and slopes are gentle. Aspects usually are southerly; Oregon white oak competes poorly on north facing slopes, thus it is too low in abundance to support the **QUGA/FRVEB** Association. Elevation averages 2,340 feet, the lowest for the Series. Ash and andesite parent rock are most common. Soils, average in fertility, but slightly more basic because of the grass influence, are less than 30 inches deep.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2340.0	339.0
Aspect (deg)	164.0	28.6
Slope (%)	14.5	3.5
Total soil depth (in)	29.5	8.3
Rooting depth (in)	23.6	.0
Total basal area (ft <sup>2</sup> /ac)	250.0	70.7

**CLIMATE:** The climate is hot and dry. Dry season precipitation is only 12 percent of total annual and soil moisture deficit can occur in mid April. Oak and Douglas-fir water use is high, and summer replacement is minimal. **PSME-QUGA/RHDI** is one of the few associations where maximum summer temperature can commonly exceed 100 degrees F. Relative humidity is low and evaporative demand is high. Biomass production is most limited by lack of atmospheric and soil moisture.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	49.3	1.0
Maximum month temp (F)	85.4	1.4
Mean annual ppt (in)	52.5	10.6
Dry season ppt (in)	6.5	.7

**FOREST FLOOR:** Amounts of litter and moss are slightly higher than average for the Series, but the soils usually are loamy and lack rock of any size.

FOREST FLOOR	MEAN	S.D.
Litter (%)	100.0	.0
Moss (%)	20.0	28.3
Bareground (%)	.0	.0
Gravel (%)	.0	.0
Rock (%)	.5	.7
Bedrock (%)	.0	.0

**VEGETATION:** Ponderosa pine is the most aggressive early seral species, followed by Douglas-fir. White fir invades sporadically, when the combination of weather conditions allow. It will eventually be associated with most stands, but it will not gain dominance. Hairy honeysuckle, poison oak, and trailing blackberry are almost always present in early seral stands, but decline in cover with canopy closure. Pacific brome and western fescue will increase with soil disturbance. The environmental extremes are indicated by white fir and Oregon oak in the tree layer. Oregon oak dominates the hottest, driest extremes of **PSME-QUGA/RHDI**. Woodland tarweed, yerba buena, and spreading dogbane are corresponding indicators.

**SILVICULTURE:** Attaining survival and maintaining growth is difficult in **PSME-QUGA/RHDI**. Moisture stress and high temperatures are common. Consequently, carbohydrates are in short supply and insect attacks often are successful, particularly during dry years. Ponderosa pine is the most appropriate species for even-age management. Douglas-fir can be used for both even and uneven-age management; while white fir is likely to die of moisture stress



in even-age regimes. Incense-cedar is resistant to insects, drought, and disease; moreover, it is shade tolerant. Early growth rates are slow, but it is likely to survive a full rotation growing adequately. Sugar pine grows well on the best sites of the Association, however, it is less drought tolerant than incense-cedar, ponderosa pine, and Douglas-fir. It tolerates mild shade well and can be used with uneven-age regimes. The potential for natural regeneration is low, but increases with increasing overstory cover. Naturally, Oregon white oak, Douglas-fir, sugar pine, incense-cedar, and white fir tend to regenerate in the understory slowly, but consistently, through succession. Soils are shallow and susceptible to compaction, puddling, and displacement. Constraining operations that expose the soils to such damage should be considered. The high probability of stagnation makes stocking level control important on poor sites, particularly if a desired diameter is required at harvest. **PSME-QUGA/RHDI** can be marginally commercial.

**WATERSHED MANAGEMENT:** **PSME-QUGA/RHDI** does not store snow, receives relatively little precipitation, has high evapotranspirational demand, low water holding capacity, and lies scattered over the District in small landscapes of less than 100 acres. It's hardly high priority watershed concern. Yet the soils are productive, easily eroded, and should not be abused.

**FIRE MANAGEMENT:** Fire, a frequent occurrence, has continually altered the composition of stands. Scars on the younger trees indicate low intensity has been the rule. Summer weather is hot and dry, and evaporative and transpirational rates are high, consequently fuels dry out early.

**RANGE & WILDLIFE MANAGEMENT:** Lack of continuous and large tracts of **PSME-QUGA/RHDI** diminish the potential for domestic livestock use. However, the unusual composition and structure provides diverse habitat for birds, mammals, and insects. Poison oak is the most abundant deciduous browse. California hazel is present, but does not produce much cover. Total herb cover averages 15 percent. Adding total average grass cover brings the total to 18 percent. This low amount of forage is only available early in the spring. Acorns are periodically available, and the oaks provide a different kind of material for wildlife habitat. Water sources usually are not available.

**RECREATION & VISUAL MANAGEMENT:** **PSME-QUGA/RHDI** provides visual variety with the oak component. There is seasonal color and the vivid reddish hue of the poison oak. With the poison oak and lack of water as negatives, the flat, relatively open sites provide opportunities for dispersed recreation. Damaged soils would be slow to recover, but Oregon white oak, incense-cedar, Pacific brome, western fescue, and red fescue would be appropriate species to use to heal overuse wounds.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
ABCO	white fir	50%	10.0	.0	becomes established during periods of low moisture stress drought tolerant
PIPO	ponderosa pine	100%	17.5	3.5	
PSME	Douglas-fir	100%	65.0	7.1	
	TOTAL OVERSTORY	100%	87.5	3.5	
ABCO	—CONIFERS—				in relatively moist areas resistant to insects, drought and disease intermediate in light tolerance
CADE3	white fir	50%	10.0	.0	
PILA	incense-cedar	50%	5.0	.0	
PSME	sugar pine	50%	2.0	.0	
	Douglas-fir	100%	10.0	7.1	hottest, driest extremes
	—HARDWOODS—				
QUGA	Oregon oak	100%	12.5	10.6	
	TOTAL UNDERSTORY	100%	31.0	5.7	
AMAL	western serviceberry	50%	3.0	.0	drier, rockier, less productive sites than where BENE occurs
BEPI	Piper's Oregongrape	50%	7.0	.0	
COCOC	California hazel	50%	3.0	.0	
LOHI	hairy honeysuckle	100%	4.5	3.5	
RHDI	poison oak	100%	27.5	3.5	hot, dry conditions hot, dry
ROGY	baldhip rose	100%	2.0	.0	
RUUR	Pacific blackberry	50%	10.0	.0	
	TOTAL SHRUB	100%	45.5	9.2	
ADBI	trail-plant, pathfinder	100%	1.5	.7	dry sites
APAN	spreading dogbane	50%	2.0	.0	
ASTER		50%	1.0	.0	
FRVEB	woods strawberry	100%	1.0	.0	
GAAP	catchweed bedstraw	100%	1.0	.0	generally warm sites
GOOB	rattlesnake-plantain	100%	1.0	0	
HIAL	white-flowered hawkweed	100%	1.5	.7	
MAMA	woodland tarweed	50%	1.0	.0	
OSCH	mountain sweet-root	100%	2.5	2.1	hot, dry and disturbed sites
PTAQ	bracken	50%	4.0	.0	
SADO	yerba buena	50%	2.0	.0	
SYRE	snow-queen	50%	2.0	.0	
	TOTAL HERB	100%	14.5	9.2	hot, dry sites
BRPA	Pacific brome	50%	1.0	.0	
FEOC	western fescue	50%	1.0	.0	
FERU	red fescue	50%	4.0	0	
	TOTAL GRASS	100%	3.0	1.4	

DOUGLAS-FIR - JEFFREY PINE  
*Pseudotsuga menziesii* - *Pinus jefferyi*  
PSME-PIJE

**EXTENT:** Occurs on the North Umpqua Ranger District and possibly the Tiller Ranger District. On the North Umpqua it occurs on Western Cascade breccias. Near Tiller it may occur on the ultrabasics of the Klamath Geological Province. N = 1 plot.

**IDENTIFYING CHARACTERISTICS:** The PSME-PIJE Association appears as an island of sparse vegetation in an otherwise dense forest. It is uncommon and supports uncommon species such as Jeffrey pine. Soils are often less than 12 inches deep, developed from breccia, and roots commonly penetrate bedrock. Grasses dominate the forest floor and incense-cedar is a common sight. Cones look like a cross between Jeffrey and ponderosa pine on the North Umpqua sites, but are more typical of Jeffrey pine on serpentine sites of the Tiller Ranger District.

**BIOTIC ENVIRONMENT:** Soils depth may vary from 12 to 20 inches with occasional outcrops of exposed bedrock. Needles and dead grass dominate the litter layer. The lack of moss, 2 percent ground cover, indicates the dryness of the predominately south aspects. Slopes are flat or convex, long (usually over 1000 feet from ridgetop to stream-bottom), and well dissected.

ABIOTIC	MEAN	S.D.
Elevation (ft)	3200.0	0.0
Aspect (deg)	183.0	.0
Slope (%)	45.0	.0
Total soil depth (in)	15.7	.0
Rooting depth (in)	15.7	.0
Total basal area (ft <sup>2</sup> /ac)	160.0	.0

**CLIMATE:** Sites are hot and dry. Shallow, coarse textured soils, south-facing slopes, and ridgetop topographic positions all contribute to the high rates of evaporation and transpiration. Moisture limits biomass production early in the growing season and limited summer rains quickly evaporate or nourish the shrub-herb layer.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	47.3	.0
Maximum month temp (F)	81.9	.0
Mean annual ppt (in)	60.0	.0
Dry season ppt (in)	7.0	.0

**FOREST FLOOR:** A combination of dead and live grass, pine needles, and exposed bedrock cover the shallow soils. Large debris, such as limbs, and trees are uncommon. Moss, which averages 14 percent ground cover in the Cascades, averages 2 percent cover on PSME-PIJE sites.

FOREST FLOOR	MEAN	S.D.
Litter (%)	80.0	.0
Moss (%)	2.0	0
Bareground (%)	1.0	0
Gravel (%)	.0	.0
Rock (%)	.0	0
Bedrock (%)	12.0	0

**VEGETATION:** Jeffrey pine dominates the overstory; Douglas-fir is rare to occasional. Jeffrey pine, incense-cedar, and a few Douglas-fir seedlings are the most apparent vegetation poking through the grass in the open park-like stands. Regeneration seems to be episodic; waves of seedlings established after a site is opened up by windthrow or light fire. Species composition is dependent on seed source and chance. Seedling distribution is infectious. Jeffrey pine and incense-cedar are likely to dominate the stand at climax, assuming future temperatures will be higher and rainfall lower.

**SILVICULTURE:** Encouraging Jeffrey pine, incense-cedar, or Douglas-fir regeneration is appropriate. Heavy animal use should be expected. If silvicultural objectives include stand establishment, mice, deer, porcupines, and elk may interfere. Jeffrey pine and incense-cedar are the most resistant to animal damage at the seedling stage, but their seed is relished by rodents. High temperatures are the most critical events limiting seedling survival.

Volume and biomass production are extremely low. Maximum basal area may be less than 200 square feet. Grasses grow well, but may interfere with tree establishment and growth. Thinning an overstocked stand is essential to achieve prescribed diameter growth. Site resources are scarce relative to other associations and the probability of stagnation is high. Density guides are not likely to apply to the **PSME-PIJE** association.

**WATERSHED MANAGEMENT:** **PSME-PIJE** is relatively unimportant as watershed, because it occurs on small (10-50 acre) patches scattered irregularly over the landscape. Annual precipitation averages about 60 inches falling mostly as rain. Although water holding capacity may be high, depending on texture, soils are shallow and field capacity usually is less than 3 inches. Thus, runoff rates are likely to be high.

**FIRE MANAGEMENT:** Not much is known about the site specific fire regimes. It would be logical to assume that specific sites take on, to some degree, frequencies of the surrounding associations. Fires should carry through most sites. Fine fuels, dead grass, and pine needles are abundant and dry early in the summer. However, coarse fuels are scarce and vertical continuity is poor. The trees, Douglas-

fir, Jeffrey pine, and incense-cedar, are all fire resistant, and the effects of ground fire are minimal.

**RANGE & WILDLIFE MANAGEMENT:** Scattered patches of **PSME-PIJE** provide habitat for large and small mammals, raptors, and other birds. They host species uncommon to nearby forests, provide edge, contrasting environments, and ecosystem functions similar to grasslands. Pellet groups, indicating deer use, are abundant. Many sites overlook river valleys and provide roosting and bedding sites in early spring and may be free of snow in late winter. Forage grasses are much more abundant than the adjacent forest and show signs of use by deer and rodents. Snags are not common; trees are not common.

**RECREATION & VISUAL MANAGEMENT:** Visual discontinuity is created by these scattered patches of grass woodlands. Up close, the grass carpet seems to invite the forest visitor, and ants. The patches usually do not occur next to streams or water sources. In fact, they are drier than adjacent forest during the summer. In some cases, they may be good viewpoints, birds seem to use them as such. Soils are fragile and would not stand heavy use.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PIJE PSME	Jeffrey pine Douglas-fir TOTAL OVERSTORY	100% 100% 100%	40.0 5.0 45.0	.0 0 0	fire resistant
CADE3 PIJE PSME	incense-cedar Jeffrey pine Douglas-fir TOTAL UNDERSTORY	100% 100% 100% 100%	10.0 15.0 20.0 45.0	.0 0 .0 .0	resistant to insects, drought and disease
BEPI CEIN RHD1 ROGY RUUR	Piper's Oregongrape deerbrush poison oak baldhip rose Pacific blackberry TOTAL SHRUB	100% 100% 100% 100% 100% 100%	1.0 1.0 2.0 1.0 1.0 6.0	.0 .0 0 .0 .0 .0	drier, rockier, less productive sites than where BENE occurs moderately dry sites hot, dry sites
ACMI CAPR3 CAAP2 CIRSI CYGR FRVEB HIAL IRCH LUPIN MAMA OSCH PSPH PTAQ	common yarrow California harebell pointed mariposa  Pacific hound's-tongue woods strawberry white-flowered hawkweed slender-tubed iris lupine spp. woodland tarweed mountain sweet-root California-tea bracken TOTAL HERB	100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100%	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 2.0 1.0 1.0 3.0 3.0 20.0	.0 0 .0 0 0 .0 .0 0 .0 .0 .0 .0 0 0	thrives in dry, disturbed areas       fixes nitrogen hot, dry and disturbed sites
BROMU CAREX ELGL POA	brome spp. sedge spp. blue wildrye  TOTAL GRASS	100% 100% 100% 100% 100%	1.0 81.0 2.0 1.0 85.0	0 .0 0 0 0	

**OREGON OAK / WOODS STRAWBERRY**  
*Quercus garryana* / *Fragaria vesca bracteata*  
**QUGA/FRVEB**

**EXTENT:** QUGA/FRVEB is known to occur on Tiller and Steamboat Ranger Districts. It occurs near the valley floor or on shallow soils. N = 4 plots.

**IDENTIFYING CHARACTERISTICS:** Overstory cover is lacking or sparse except for a few ponderosa pine standing above a discontinuous canopy of Oregon oak. Oregon oak, with occasional ponderosa pine, sugar pine, or Douglas-fir, constitutes the understory and distinguishes QUGA/FRVEB from other series and associations.

**ABIOTIC ENVIRONMENT:** The shallow (9 inches) soils developed from a variety of fine grained igneous rock (andesite, ash, and basalt). The transition from soil to bedrock often is abrupt. The rock is competent and extremely resistant to weathering. Generally found on the middle third of the slope, with flat microtopography, the slopes are gentle and usually face southeast.

ABIOTIC	MEAN	S.D.
Elevation (ft)	2135.0	389.0
Aspect (deg)	123.7	57.9
Slope (%)	24.7	27.3
Total soil depth (in)	8.9	2.6
Rooting depth (in)	11.1	5.9
Total basal area (ft <sup>2</sup> /ac)	46.2	56.8

**CLIMATE:** Average annual temperature is about 5 degrees F. higher than the Cascade average. If 5 degree increases in temperature occur as part of the 'greenhouse' effect predicted by scientists, these are the type of stands that may eventually develop at midslopes in the Cascades. Maximum monthly temperature (an average of the highs for the hottest month) indicates readings of over 90 degrees are common. Rainfall is low and although the soil has a high water holding capacity, it is too shallow to store much more than an inch of water. Water deficits significantly limit survival and growth.

CLIMATE	MEAN	S.D.
Mean annual temp (F)	49.8	1.1
Maximum month temp (F)	86.1	1.5
Mean annual ppt (in)	50.0	7.1
Dry season ppt (in)	7.0	.8

**FOREST FLOOR:** Soils developed from hard basalts, dacite, rhyolite, and pumice. Dacite and rhyolite tend to produce relatively infertile, shallow soils; but generally basalts produce deep fertile soils. On these sites they must be hard and resistant to weathering. Duff consists mostly of leaves and needles. Although depths are shallow, bare soil and exposed rock are rare.

FOREST FLOOR	MEAN	S.D.
Litter (%)	90.7	3.0
Moss (%)	16.2	29.3
Bareground (%)	2.8	2.2
Gravel (%)	2.8	4.9
Rock (%)	3.0	4.8
Bedrock (%)	.0	.0

**VEGETATION:** The herb layer is by far the richest and possibly the most active layer. Tree growth is slow, and quite a bit of biomass is produced and cycled in the soil-atmosphere interface. Lilies and thistle are common. Lily bulbs store materials and seem to be able to draw upon them even if water availability is low. The thistles indicate the heavy animal use and delicate soil surface. There are effective pioneers on even lightly disturbed soil surfaces. Ponderosa pine is scattered and rare. Oregon oak dominates the sparse understory, with few conifers present (ponderosa pine, sugar pine, or Douglas-fir). California hazel, poison oak, baldhip rose, and common snowberry are clumped on islands of deeper soil. The herb layer consists primarily of woods strawberry. Hedgehog dogtail, the common grass, correspondingly indicates heavy grazing.

**SILVICULTURE:** About half of the QUGA/FRVEB Association may not be suitable for timber produc-

tion. Ponderosa pine, white oak, and Douglas-fir X cactus are appropriate for use in reforestation. White oak naturals are more common than ponderosa pine. In either case, growth is less than poor. Although the slopes are gentle, even skidders would significantly displace and expose the soil.

**WATERSHED MANAGEMENT:** Precipitation ( 45 inches), the lowest of all associations, falls on soils with a field capacity of less than 2 inches. Runoff is high, but the area involved is small. On Forest Service land, QUGA/FRVEB occurs as scattered patches at the very lowest elevations. Snow rarely accumulates, and when it does, it soon melts.

**FIRE MANAGEMENT:** Fire occurred on three of the four sites sampled. Frequency is high, intensity is low, and many fires are confined to the type, without entering adjacent dense forested sites. Spread rates are moderated by the gentle topography. Heavy fuel production is low, but flashy fuels (grasses) are abundant and dry early in the summer. Vertical and horizontal fuel distribution is discontinuous

and varied. Surface area, except for the grasses, is low.

**RANGE & WILDLIFE MANAGEMENT:** Sites are widely used for winter range by deer and mice. Trophy size deer mice have been harvested from the area as hiding cover is low. QUGA/FRVEB is excellent hunting ground for raptors. Some areas have small seeps that contribute to the overall habitat diversity and clumpiness of the Association.

**RECREATION &- VISUAL MANAGEMENT:** The open, grassy environment is appealing. Camping, hunting, and hiking would be a pleasant experience, although the areas with seeps do not provide an adequate water source. There are a number of attractive lilies and other interesting flowering plants. Birding also has potential. The only drawback is the delicate soil. Light use could damage the soil's ability to support erosion protection cover and revegetation is likely to be difficult in the hot, dry environment.

# PLANT SPECIES BY VEGETATION LAYER

CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
PIPO QUGA	ponderosa pine Oregon oak TOTAL OVERSTORY	50% 25% 100%	10.5 3.0 6.0	13.4 .0 9.4	
ABCO PILA PIPO PSME ARME QUGA	—CONIFERS— white fir sugar pine ponderosa pine Douglas-fir —HARDWOODS— Pacific madrone Oregon oak TOTAL UNDERSTORY	25% 25% 50% 25% 25% 100% 100%	3.0 5.0 16.0 3.0 8.0 19.5 32.2	.0 .0 15.6 .0 .0 19.7 37.7	indicates cooler, moister sites fire resistant fire resistant evidence of fire history
BEPI CEIN COCOC HODI LOCI LOHI RHD1 ROGY SYAL WHMO	Piper's Oregongrape deerbrush California hazel creambush ocean-spray trumpet honeysuckle hairy honeysuckle poison oak balddip rose common snowberry whipplevine TOTAL SHRUB	25% 25% 50% 25% 25% 50% 50% 50% 25% 100%	8.0 1.0 4.5 3.0 1.0 4.0 10.0 2.5 3.5 8.0 16.2	.0 .0 2.1 .0 .0 .0 7.1 .7 2.1 .0 21.6	drier, rockier, less productive sites than where BENE occurs moderately dry sites occurs on deeper soils warm to dry sites, often rocky, shallow soils hot, dry sites hot, dry sites islands of deeper soils
ACMI BREL CIAR CLAMC CLRH FRVEB GAVE2 HYPE IRIS LOMAT MAMA MAOR MIGU NAIN OSCH PEBO POTEN PSPH SADO SILEN VIAM	common yarrow elegant brodiaea Canadian thistle farewell-to-spring common clarkia woods strawberry lady's bedstraw Klamath weed iris spp. woodland tarweed Oregon bigroot yellow monkey-flower needle-leaf navaretia mountain sweet-root Bolander's yampah California-tea yerba buena American vetch TOTAL HERB	50% 50% 25% 25% 25% 75% 25% 50% 25% 25% 50% 25% 25% 50% 50% 25% 25% 25% 50% 100%	13.0 1.0 1.0 1.0 5.0 10.0 1.0 1.5 2.0 1.0 16.0 1.0 1.0 1.0 3.5 1.0 2.0 1.0 1.5 31.2	17.0 .0 0 .0 .0 8.7 0 .7 0 .0 19.8 .0 .0 0 3.5 .0 .0 .0 7 32.7	thrives in dry, disturbed areas indicates heavy animal use hot, dry site hot, dry conditions



CODE	SPECIES	CONST	MEAN	S.D.	REMARKS
BRCI	fringed brome	25%	12.0	.0	
BRIN	smooth brome	25%	2.0	0	
BRMO	soft brome	25%	2.0	0	
BRPA	Pacific brome	25%	2.0	.0	
CYEC	hedgehog dogtail	100%	29.5	29.7	
DAGL	orchard-grass	25%	2.0	.0	
DACA	California oatgrass	50%	15.5	20.5	
DAIN	timber oatgrass	25%	6.0	.0	
FEID	Idaho fescue	25%	1.0	.0	
FERU	red fescue	50%	10.0	7.1	
PHPR	common timothy	25%	1.0	.0	
POA		25%	15.0	.0	
STLE	Letterman's needlegrass	25%	5.0	.0	
	TOTAL GRASS	100%	55.2	51.2	

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## SPECIES SORTED BY SCIENTIFIC NAME

Family	Scientific name	Common name	Code
Pinaceae	<i>Abies amabilis</i>	Pacific silver fir	ABAM
Pinaceae	<i>Abies concolor</i>	white fir	ABCO
Pinaceae	<i>Abies grandis</i>	grand fir	ABGR
Pinaceae	<i>Abies lasiocarpa</i>	subalpine fir	ABLA2
Pinaceae	<i>Abies magnifica shastensis</i>	Shasta red fir	ABMAS
Nyctaginaceae	<i>Abronia umbellata acutalata</i>	pink sea beach plant	ABUMA
Nyctaginaceae	<i>Abronia umbellata breviflora</i>	pink sea beach plant	ABUMB
Aceraceae	<i>Acer circinatum</i>	vine maple	ACCI
Aceraceae	<i>Acer glabrum</i>	Douglas (Rocky Mountain) maple	ACGL
Aceraceae	<i>Acer macrophyllum</i>	big-leaf maple	ACMA
Compositae	<i>Achillea millefolium</i>	common yarrow	ACMI
Berberidaceae	<i>Achlys triphylla</i>	vanillaleaf	ACTR
Ranunculaceae	<i>Aconitum columbianum</i>	Columbia monkshood	ACCO
Ranunculaceae	<i>Actaea rubra</i>	baneberry	ACRU
Compositae	<i>Adenocaulon bicolor</i>	trail-plant, pathfinder	ADBI
Polypodiaceae	<i>Adiantum capillus-veneris</i>	Venus-hair fern	ADCA
Polypodiaceae	<i>Adiantum pedatum</i>	northern maidenhair	ADPE
Labiatae	<i>Agastache urticifolia</i>	nettle-leaf horse-mint	AGUR
Compositae	<i>Agoseris grandiflora</i>	large-flowered agoseris	AGGR
Gramineae	<i>Agrostis albarectop</i>		AGAL
Gramineae	<i>Agrostis hallii</i>	Hall's bentgrass	AGHA
Gramineae	<i>Agrostis variabilis</i>	variant bentgrass	AGVA
Gramineae	<i>Aira caryophyllea</i>	silver hairgrass	AICA
Gramineae	<i>Aira praecox</i>	early hairgrass	AIPR
Liliaceae	<i>Allium bolanderi</i>	Bolander's onion	ALBO
Liliaceae	<i>Allium campanulatum</i>	Sierra onion	ALCA
Liliaceae	<i>Allium falcifolium</i>	sickleleaf onion	ALFA
Liliaceae	<i>Allium peninsulare</i>	peninsulare onion	ALPE
Liliaceae	<i>Allium siskiyouense</i>	Siskiyou onion	ALSI3
Liliaceae	<i>Allium tolmiei</i>	Tolmie's onion	ALTO
Ericaceae	<i>Allotropa virgata</i>	candystick	ALVI
Betulaceae	<i>Alnus rubra</i>	red alder	ALRU
Betulaceae	<i>Alnus sinuata</i>	Sitka alder	ALSI
Rosaceae	<i>Amelanchier alnifolia</i>	western serviceberry	AMAL
Rosaceae	<i>Amelanchier pallida</i>	pale serviceberry	AMPA
Compositae	<i>Anaphalis margaritacea</i>	common pearly-everlasting	ANMA
Ranunculaceae	<i>Anemone deltoidea</i>	threeleaf anemone	ANDE
Ranunculaceae	<i>Anemone drummondii</i>	Drummond anemone	ANDR
Ranunculaceae	<i>Anemone lyallii</i>	Lyall anemone	ANLY2
Umbelliferae	<i>Angelica arguta</i>	sharptooth angelica	ANAR2
Compositae	<i>Antennaria neglecta</i>	field pussy-toes	ANNE2
Compositae	<i>Antennaria racemosa</i>	raceme pussy-toes	ANRA
Compositae	<i>Antennaria suffrutescens</i>	shrubby everlasting	ANSU
Apocynaceae	<i>Apocynum androsaemifolium</i>	spreading dogbane	APAN
Ranunculaceae	<i>Aquilegia formosa</i>	Sitka columbine	AQFO
Cruciferae	<i>Arabidopsis thaliana</i>	Thale cress	ARTH
Cruciferae	<i>Arabis aculeolata</i>	Waldo rockcress	ARAC
Cruciferae	<i>Arabis glabra</i>	towermustard	ARGL

Family	Scientific name	Common name	Code
Cruciferae	<i>Arabis hirsuta</i>	hairy rockcress	ARHI
Cruciferae	<i>Arabis holboellii</i>	Holboell's sandwort	ARHO
Cruciferae	<i>Arabis koehleri stipitata</i>	Koehler's rockcress	ARKOS
Cruciferae	<i>Arabis macdonaldiana</i>	McDonald's rockcress	ARMC
Cruciferae	<i>Arabis modesta</i>	Rogue Canyon rockcress	ARMO2
Cruciferae	<i>Arabis oregana</i>	Oregon rockcress	AROR
Cruciferae	<i>Arabis platysperma</i>	flatseed rockcress	ARPL
Cruciferae	<i>Arabis platysperma howellii</i>	flatseed rockcress	ARPLH
Cruciferae	<i>Arabis puberula</i>	hoary rockcress	ARPU
Cruciferae	<i>Arabis serpentinicola</i>	serpentine rockcress	ARSE2
Cruciferae	<i>Arabis suffrutescens</i> <i>horizontalis</i>	woody-stemmed rockcress	ARSUPH
Ericaceae	<i>Arbutus menziesii</i>	Pacific madrone	ARME
Ericaceae	<i>Arctostaphylos cinerea</i>	Del Norte manzanita	ARCI
Ericaceae	<i>Arctostaphylos columbiana</i>	hairy manzanita	ARCO3
Ericaceae	<i>Arctostaphylos hispidula</i>	Howell's manzanita	ARHI2
Ericaceae	<i>Arctostaphylos nevadensis</i>	pinemat manzanita	ARNE
Ericaceae	<i>Arctostaphylos patula</i>	greenleaf manzanita	ARPA
Ericaceae	<i>Arctostaphylos viscida</i>	whiteleaf manzanita	ARVI
Caryophyllaceae	<i>Arenaria californica</i>	California sandwort	ARCA7
Caryophyllaceae	<i>Arenaria howellii</i>	Howell's sandwort	ARHO2
Caryophyllaceae	<i>Arenaria macrophylla</i>	bigleaf sandwort	ARMA3
Caryophyllaceae	<i>Arenaria nuttallii</i>	Nuttall's sandwort	ARNU
Caryophyllaceae	<i>Arenaria paludicola</i>	swamp sandwort	ARPA4
Caryophyllaceae	<i>Arenaria stricta</i>	slender sandwort	ARST
Compositae	<i>Arnica cernua</i>	nodding arnica	ARCE
Compositae	<i>Arnica cordifolia</i>	heart-leaf arnica	ARCO
Compositae	<i>Arnica discoidea</i>	rayless arnica	ARDI
Compositae	<i>Arnica latifolia</i>	mountain arnica	ARLA
Compositae	<i>Arnica parryi</i>	nodding arnica	ARPA3
Compositae	<i>Arnica spathulata spathulata</i>	Klamath arnica	ARSPS
Compositae	<i>Arnica tomentella</i>	recondite arnica	ARTO2
Compositae	<i>Arnica viscosa</i>		ARVI2
Gramineae	<i>Arrhenatherum elatius</i>	tall oatgrass	AREL
Compositae	<i>Artemisia ludoviciana</i>	Louisiana sagebrush	ARLU
Compositae	<i>Artemisia tridentata</i>	big sagebrush	ARTR
Rosaceae	<i>Aruncus sylvestris</i>	Sylvan goatsbeard	ARSY
Aristolochiaceae	<i>Asarum caudatum</i>	western wild ginger	ASCA3
Aristolochiaceae	<i>Asarum hartwegi</i>	marbled wild ginger	ASHA
Aristolochiaceae	<i>Asarum wagneri</i>	Wagner's wild ginger	ASWA
Asclepidaceae	<i>Asclepias solanoana</i>	prostrate milkweed	ASSO2
Polypodiaceae	<i>Aspidotis densa</i>	rock fern	ASDE
Polypodiaceae	<i>Asplenium septentrionale</i>		ASSE
Polypodiaceae	<i>Asplenium trichomanes</i>	maidenhair spleenwort	ASTR
Compositae	<i>Aster brickelliioides</i>	rayless aster	ASBR
Compositae	<i>Aster brickelliioides</i> <i>glabratus</i>	rayless aster	ASBRG
Compositae	<i>Aster conspicuus</i>	showy aster	ASCO
Compositae	<i>Aster novae-angliae</i>	New England aster	ASNO
Compositae	<i>Aster radulinus</i>	rough-leaved aster	ASRA

Family	Scientific name	Common name	Code
Leguminosae	<i>Astragalus accidens hendersonii</i>	thicket milk-vetch	ASACH
Leguminosae	<i>Astragalus lentiginosus carinatus</i>	freckled milk-vetch	ASLEC
Leguminosae	<i>Astragalus umbraticus</i>	woodland milk-vetch	ASUM
Leguminosae	<i>Astragalus whitneyi</i>	balloon milk-vetch	ASWH
Polypodiaceae	<i>Athyrium filix-femina</i>	lady-fern	ATFI
Compositae	<i>Baeria minor</i>	small goldfields	BAMI
Compositae	<i>Balsamorhiza deltoidea</i>	Puget balsamroot	BADE
Compositae	<i>Balsamorhiza sericea</i>	silky balsamroot	BASE2
Saxifragaceae	<i>Bensoniella oregona</i>	bensonia	BEOR
Berberidaceae	<i>Berberis aquifolium</i>	tall Oregongrape	BEAQ
Berberidaceae	<i>Berberis nervosa</i>	dwarf Oregongrape	BENE
Berberidaceae	<i>Berberis piperiana</i>	Piper's Oregongrape	BEPI
Berberidaceae	<i>Berberis pumila</i>	pygmy Oregongrape	BEPU
Berberidaceae	<i>Berberis repens</i>	creeping Oregongrape	BERE
Polypodiaceae	<i>Blechnum spicant</i>	deer-fern	BLSP
Compositae	<i>Blepharipappus scaber</i>	blepharipappus	BLSC
Orobanchaceae	<i>Boschniakia strobilacea</i>	ground-cone	BOST2
Ophioglossaceae	<i>Botrychium pumicola</i>	Oregon grape-fern	BOPU
Ophioglossaceae	<i>Botrychium virginianum</i>	Virginia grape-fern	BOVI
Saxifragaceae	<i>Boykinia elata</i>	slender boykinia	BOEL
Saxifragaceae	<i>Boykinia major</i>	mountain boykinia	BOMA
Liliaceae	<i>Brodiaea congesta</i>	Columbia brodiaea	BRCO3
Liliaceae	<i>Brodiaea crocea</i>	yellow brodiaea	BRCR
Liliaceae	<i>Brodiaea elegans</i>	elegant brodiaea	BREL
Liliaceae	<i>Brodiaea hendersonii</i>	Henderson's brodiaea	BRHE
Liliaceae	<i>Brodiaea hendersonii leachiae</i>	Henderson's brodiaea	BRHEL
Liliaceae	<i>Brodiaea ida-maia</i>	fire-cracker flower	BRID
Liliaceae	<i>Brodiaea laxa</i>	grass nut	BRLA2
Liliaceae	<i>Brodiaea terrestris</i>	dwarf brodiaea	BRTE2
Gramineae	<i>Bromus carinatus</i>	California brome	BRCA
Gramineae	<i>Bromus ciliatus</i>	fringed brome	BRCI
Gramineae	<i>Bromus erectus</i>	meadow brome	BRER
Gramineae	<i>Bromus inermis</i>	smooth brome	BRIN
Gramineae	<i>Bromus mollis</i>	soft brome	BRMO
Gramineae	<i>Bromus pacificus</i>	Pacific brome	BRPA
Gramineae	<i>Bromus suksdorfii</i>	Suksdorf's brome	BRSU
Gramineae	<i>Bromus tectorum</i>	cheat grass	BRTE
Gramineae	<i>Bromus vulgaris</i>	Columbia brome	BRVU
Gramineae	<i>Calamagrostis canadensis</i>	bluejoint reedgrass	CACA
Gramineae	<i>Calamagrostis koelerioides</i>	fire reedgrass	CAKO
Gramineae	<i>Calamagrostis purpurascens</i>	purple reedgrass	CAPU
Cupressaceae	<i>Calocedrus decurrens</i>	incense-cedar	CADE3
Liliaceae	<i>Calochortus apiculatus</i>	pointed mariposa	CAAP
Liliaceae	<i>Calochortus elegans</i>	northwest mariposa	CAEL
Liliaceae	<i>Calochortus greenei</i>	Green's mariposa	CAGR2
Liliaceae	<i>Calochortus howellii</i>	Howell's mariposa lily	CAHO3
Liliaceae	<i>Calochortus indecorus</i>	indecorus mariposa lily	CAIN8

Family	Scientific name	Common name	Code
Liliaceae	<i>Calochortus tolmiei</i>	Tolmie's mariposa	CATO
Liliaceae	<i>Calochortus uniflorus</i>	Monterey mariposa	CAUN
Ranunculaceae	<i>Caltha biflora</i>	white marshmarigold	CABI
Ranunculaceae	<i>Caltha biflora biflora</i>	broad-leaved caltha	CABIB
Orchidaceae	<i>Calypso bulbosa</i>	fairy-slipper	CABU2
Liliaceae	<i>Camassia howellii</i>	Howell's camas	CAHO4
Liliaceae	<i>Camassia quamash</i>	common camas	CAQU
Onagraceae	<i>Camissonia graciliflora</i>		CAGR3
Campanulaceae	<i>Campanula prenanthoides</i>	California harebell	CAPR3
Campanulaceae	<i>Campanula scabrella</i>	rough harebell	CASC
Campanulaceae	<i>Campanula scouleri</i>	Scouler's harebell	CASC2
Cruciferae	<i>Cardamine pulcherrima</i>		
	<i>pulcherrima</i>	slender bittercress	CAPUP
Cruciferae	<i>Cardamine pulcherrima</i>		
	<i>tenella</i>	slender bittercress	CAPUT
Cyperaceae	<i>Carex concinnoides</i>	northwestern sedge	CACO
Cyperaceae	<i>Carex eurycarpa</i>	wide-fruit sedge	CAEU
Cyperaceae	<i>Carex feta</i>	greensheathed sedge	CAFE2
Cyperaceae	<i>Carex fracta</i>	fragile-sheathed sedge	CAFR
Cyperaceae	<i>Carex geyeri</i>	elk sedge	CAGE
Cyperaceae	<i>Carex gigas</i>	Siskiyou sedge	CAGI
Cyperaceae	<i>Carex halliana</i>	Hall's sedge	CAHA2
Cyperaceae	<i>Carex hoodii</i>	Hood's sedge	CAHO
Cyperaceae	<i>Carex jonesii</i>	Jones' sedge	CAJO
Cyperaceae	<i>Carex limosa</i>	mud sedge	CALI
Cyperaceae	<i>Carex pensylvanica</i>	long stolon sedge	CAPE5
Cyperaceae	<i>Carex rossii</i>	Ross sedge	CARO
Cyperaceae	<i>Carex scabriuscula</i>	Cascade sedge	CASC6
Fagaceae	<i>Castanopsis chrysophylla</i>	golden chinquapin	CACH
Scrophulariaceae	<i>Castilleja applegatei</i>	Applegate's paintbrush	CAAP2
Scrophulariaceae	<i>Castilleja applegatei</i>		
	<i>applegatei</i>	Applegate's paintbrush	CAAPA
Scrophulariaceae	<i>Castilleja brevilobata</i>	short-lobed paintbrush	CABR8
Scrophulariaceae	<i>Castilleja elata</i>	slender paintbrush	CAEL3
Rhamnaceae	<i>Ceanothus cuneatus</i>	buckbrush	CECU
Rhamnaceae	<i>Ceanothus integerrimus</i>	deerbrush	CEIN
Rhamnaceae	<i>Ceanothus prostratus</i>	squaw carpet	CEPR
Rhamnaceae	<i>Ceanothus prostratus laxus</i>	squaw carpet	CEPRL
Rhamnaceae	<i>Ceanothus sanguineus</i>	redstem ceanothus	CESA
Rhamnaceae	<i>Ceanothus thyrsiflorus</i>	blue blossom ceanothus	CETH
Rhamnaceae	<i>Ceanothus velutinus</i>	snowbrush	CEVE
Caryophyllaceae	<i>Cerastium arvense</i>	field chickweed	CEAR
Rosaceae	<i>Cercocarpus ledifolius</i>	curl-leaf mountain-mahogany	CELE
Rosaceae	<i>Cercocarpus montanus</i>	birchleaf mountain-mahogany	CEMO
Compositae	<i>Chaenactis douglasii</i>	hoary false-yarrow	CHDO
Cupressaceae	<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	CHLA
Cupressaceae	<i>Chamaecyparis nootkatensis</i>	Alaska-cedar	CHNO
Polypodiaceae	<i>Cheilanthes intertexta</i>		CHIN
Ericaceae	<i>Chimaphila menziesii</i>	little prince's-pine	CHME



Family	Scientific name	Common name	Code
Ericaceae	<i>Chimaphila umbellata</i>	common prince's-pine	CHUM
Compositae	<i>Chrysothamnus nauseosus</i>	common rabbit-brush	CHNA
Compositae	<i>Chrysothamnus viscidiflorus</i>	green rabbit-brush	CHVI
Onagraceae	<i>Circaea alpina</i>	alpine circaea	CIAL
Compositae	<i>Cirsium arvense</i>	Canadaian thistle	CIAR
Compositae	<i>Cirsium ciliolatum</i>	cirsium	CICI
Onagraceae	<i>Clarkia amoena caurina</i>	farewell-to-spring	CLAMC
Onagraceae	<i>Clarkia gracilis</i>	slender gracilis	CLGR
Onagraceae	<i>Clarkia purpurea</i>	purple gracilis	CLPU2
Onagraceae	<i>Clarkia rhomboidea</i>	common clarkia	CLRH
Liliaceae	<i>Clintonia andrewsiana</i>	red clintonia	CLAN
Liliaceae	<i>Clintonia uniflora</i>	queen's cup	CLUN
Scrophulariaceae	<i>Collinsia grandiflora</i>	large-flowered blue-eyed Mary	COGR
Scrophulariaceae	<i>Collinsia greenei</i>	Green's blue-eyed Mary	COGR3
Scrophulariaceae	<i>Collinsia linearis</i>	narrow-leaved blue-eyed Mary	COLI
Scrophulariaceae	<i>Collinsia parviflora</i>	small-flowered blue-eyed Mary	COPA
Scrophulariaceae	<i>Collinsia rattanii</i>	Rattan blue-eyed Mary	CORA2
Polemoniaceae	<i>Collomia heterophylla</i>	varied-leaved collomia	COHE
Polemoniaceae	<i>Collomia mazama</i>	Mt. Mazama collomia	COMA
Convolvulaceae	<i>Convolvulus nyctagineus</i>	night-blooming morning-glory	CONY
Convolvulaceae	<i>Convolvulus polymorphus</i>	variable morning-glory	COPO
Convolvulaceae	<i>Convolvulus subacaulis</i>	California morning-glory	COSU
Ranunculaceae	<i>Coptis laciniata</i>	cutleaf goldthread	COLA
Orchidaceae	<i>Corallorhiza maculata</i>	spotted coral-root	COMA3
Orchidaceae	<i>Corallorhiza mertensiana</i>	Pacific coral-root	·COME
Orchidaceae	<i>Corallorhiza striata</i>	hooded coral-root	COST2
Scrophulariaceae	<i>Cordylanthus maritimus</i>		
	<i>maritimus</i>	salt-marsh birdbeak	COMAM
Scrophulariaceae	<i>Cordylanthus maritimus</i>		
	<i>palustris</i>	salt-marsh birdbeak	COMAP
Cornaceae	<i>Cornus canadensis</i>	bunchberry	COCA
Cornaceae	<i>Cornus nuttallii</i>	Pacific dogwood	CONU
Cornaceae	<i>Cornus stolonifera</i>	red-osier dogwood	COST
Betulaceae	<i>Corylus cornuta californica</i>	California hazel	COCOC
Compositae	<i>Crepis acuminata</i>	long-leaved hawksbeard	CRAC
Compositae	<i>Crepis pleurocarpa</i>	naked-stemmed hawksbeard	CRPL
Boraginaceae	<i>Cryptantha milobakeri</i>		CRMI
Boraginaceae	<i>Cryptantha simulans</i>	pinewoods cryptantha	CRSI
Polypodiaceae	<i>Cryptogramma crispa</i>	rock-brake	CRCR
Cupressaceae	<i>Cupressus bakeri matthewsii</i>	Siskiyou cypress	CUBAM
Boraginaceae	<i>Cynoglossum grande</i>	Pacific hound's-tongue	CYGR
Boraginaceae	<i>Cynoglossum occidentale</i>	western hound's-tongue	CYOC
Gramineae	<i>Cynosurus echinatus</i>	hedgehog dogtail	CYEC
Orchidaceae	<i>Cypripedium californicum</i>	California lady's-slipper	CYCA
Orchidaceae	<i>Cypripedium fasciculatum</i>	clustered lady's-slipper	CYFA
Orchidaceae	<i>Cypripedium montanum</i>	mountain lady's-slipper	CYMO
Gramineae	<i>Dactylis glomerata</i>	orchard-grass	DAGL
Gramineae	<i>Danthonia californica</i>	California oatgrass	DACA
Gramineae	<i>Danthonia intermedia</i>	timber oatgrass	DAIN
Sarraceniaceae	<i>Darlingtonia californica</i>	California pitcher-plant	DACA3

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Umbelliferae	<i>Daucus carota</i>	wild carrot	DACA4
Ranunculaceae	<i>Delphinium depauperatum</i>	dwarf larkspur	DEDE
Ranunculaceae	<i>Delphinium troliifolium</i>	Columbia River larkspur	DETR
Ranunculaceae	<i>Delphinium xantholeucum</i>	yellow-white larkspur	DEXA
Cruciferae	<i>Dentaria gemmata</i>	purple toothwort	DEGE
Gramineae	<i>Deschampsia caespitosa</i>	tufted hairgrass	DECA
Gramineae	<i>Deschampsia danthonioides</i>	annual hairgrass	DEDA
Gramineae	<i>Deschampsia elongata</i>	slender hairgrass	DEEL
Cruciferae	<i>Descurainia pinnata</i>	western tansymustard	DEPI
Fumariaceae	<i>Dicentra formosa</i>	Pacific bleedingheart	DIFO
Fumariaceae	<i>Dicentra formosa oregana</i>	Oregon bleedingheart	DIFOO
Fumariaceae	<i>Dicentra pauciflora</i>	few-flowered dicentra	DIPA
Liliaceae	<i>Dichelostemma venustum</i>		DIVE
Liliaceae	<i>Disporum hookeri oreganum</i>	Oregon fairybell	DIHOO
Liliaceae	<i>Disporum smithii</i>	Smith fairybell	DISM
Primulaceae	<i>Dodecatheon hendersoni</i>	hendersons shootingstar	DOHE
Cruciferae	<i>Draba howellii</i>	Howell's whitlow-grass	DRHO
Polypodiaceae	<i>Dryopteris austriaca</i>	mountain wood-fern	DRAU2
Crassulaceae	<i>Dudleya farinosa</i>	sea-cliff stonecrop	DUFA
Orchidaceae	<i>Eburophyton austinae</i>	phantom-orchid	EBAU
Gramineae	<i>Elymus glaucus</i>	blue wildrye	ELGL
Onagraceae	<i>Epilobium angustifolium</i>	fireweed	EPAN
Onagraceae	<i>Epilobium luteum</i>	yellow willow-herb	EPLU
Onagraceae	<i>Epilobium minutum</i>	small-flowered willow-herb	EPMI
Onagraceae	<i>Epilobium oregonense</i>	Oregon willow-herb	EPOR2
Onagraceae	<i>Epilobium paniculatum</i>	autumn willow-herb	EPPA
Onagraceae	<i>Epilobium rigidum</i>	rigid willow-herb	EPRI
Onagraceae	<i>Epilobium siskiyouense</i>	Siskiyou willow-herb	EPSI
Equisetaceae	<i>Equisetum arvense</i>	common horsetail	EQAR
Compositae	<i>Erigeron aliceae</i>	Alice fleabane	ERAL
Compositae	<i>Erigeron bloomeri nudatus</i>	scabland fleabane	ERBLN
Compositae	<i>Erigeron cascadenis</i>	Cascade daisy	ERCA6
Compositae	<i>Erigeron cervinus</i>	deer fleabane	ERCE2
Compositae	<i>Erigeron linearis</i>	line-leaf fleabane	ERLI
Compositae	<i>Erigeron petrophilus</i>	fleabane	ERPE5
Compositae	<i>Erigeron pumilus</i>	shaggy fleabane	ERPU
Compositae	<i>Erigeron subtrinervis</i>	three-veined fleabane	ERSU2
Polygonaceae	<i>Eriogonum congdonii</i>	Congdon's buckwheat	ERCO6
Polygonaceae	<i>Eriogonum diclinum</i>	buckwheat-knotweed	ERDI3
Polygonaceae	<i>Eriogonum elatum</i>	tall buckwheat	EREL2
Polygonaceae	<i>Eriogonum hirtellum</i>	Klamath Mt. wild buckwheat	ERHI2
Polygonaceae	<i>Eriogonum incanum</i>	white dwarf buckwheat	ERIN
Polygonaceae	<i>Eriogonum nudum</i>	barestem buckwheat	ERNU
Polygonaceae	<i>Eriogonum pendulum</i>	long stalked buckwheat	ERPE6
Polygonaceae	<i>Eriogonum pyrolifolium</i>		
	<i>coryphaeum</i>	alpine buckwheat	ERPYC
Polygonaceae	<i>Eriogonum siskiyouense</i>	Siskiyou buckwheat	ERSI2
Polygonaceae	<i>Eriogonum ternatum</i>	Waldo buckwheat	ERTE2
Polygonaceae	<i>Eriogonum umbellatum</i>	sulphurflower	ERUM

Family	Scientific name	Common name	Code
Polygonaceae	Eriogonum umbellatum polyanthum	sulphurflower	ERUMP
Polygonaceae	Eriogonum umbellatum stellatum	sulphurflower	ERUMS
Polygonaceae	Eriogonum vimineum	broom buckwheat	ERVI
Compositae	Eriophyllum lanatum	common eriophyllum	ERLA
Cruciferae	Erysimum asperum	prairie rocket wallflower	ERAS
Liliaceae	Erythronium citrinum	fawn-lily	ERIC3
Liliaceae	Erythronium grandiflorum	pale fawn-lily	ERGR
Liliaceae	Erythronium grandiflorum grandiflorum	yellow fawn-lily	ERGRG
Liliaceae	Erythronium hendersonii	Henderson's fawn-lily	ERHE2
Liliaceae	Erythronium howellii	Howell's fawn-lily	ERHO2
Liliaceae	Erythronium revolutum	pink fawn-lily	ERRE2
Papaveraceae	Eschscholzia caespitosa	California poppy	ESCA2
Gramineae	Festuca californica	California fescue	FECA
Gramineae	Festuca elatior	meadow fescue	FEEL
Gramineae	Festuca idahoensis	Idaho fescue	FEID
Gramineae	Festuca occidentalis	western fescue	FEOC
Gramineae	Festuca ovina	sheep fescue	FEOV
Gramineae	Festuca pacifica	Pacific fescue	FEPA
Gramineae	Festuca pratensis	meadow fescue	FEPR
Gramineae	Festuca rubra	red fescue	FERU
Gramineae	Festuca subulata	bearded fescue	FESU
Gramineae	Festuca subuliflora	crinkle awn fescue	FESU2
Umbelliferae	Foeniculum vulgare	sweet fennel	FOVU
Rosaceae	Fragaria vesca bracteata	woods strawberry	FRVEB
Gentianaceae	Frasera albicaulus nitida	shiny fraseria	FRALN
Gentianaceae	Frasera speciosa	giant fraseria	FRSP
Gentianaceae	Frasera umpquaensis	Umpqua fraseria	FRUM
Oleaceae	Fraxinus latifolia	Oregon ash	FRLA2
Liliaceae	Fritillaria atropurpurea	checker lily	FRAT
Liliaceae	Fritillaria falcata		FRFA2
Liliaceae	Fritillaria gentneri	fritillaria	FRGE
Liliaceae	Fritillaria glauca	Siskiyou fritillaria	FRGL2
Liliaceae	Fritillaria lanceolata	checker lily	FRLA
Liliaceae	Fritillaria pudica	yellow bell	FRPU
Rubiaceae	Galium ambiguum	obscure bedstraw	GAAM
Rubiaceae	Galium aparine	catchweed bedstraw	GAAP
Rubiaceae	Galium bifolium	thinleaf bedstraw	GABI
Rubiaceae	Galium boreale	northern bedstraw	GABO
Rubiaceae	Galium oreganum	Oregon bedstraw	GAOR
Rubiaceae	Galium triflorum	fragrant bedstraw	GATR
Rubiaceae	Galium verum	lady's bedstraw	GAVE
Garryaceae	Garrya buxifolia	box-leaved silk-tassel	GABU
Garryaceae	Garrya fremontii	Fremont silk-tassel	GAFR
Gramineae	Gastridium ventricosum	nitgrass	GAVE2
Ericaceae	Gaultheria ovatifolia	slender salal	GAOV
Ericaceae	Gaultheria shallon	salal	GASH
Onagraceae	Gayophytum diffusum	spreading groundsmoke	GADI

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Gentianaceae	<i>Gentiana affinis affinis</i>	pleated gentian	GEAFA
Gentianaceae	<i>Gentiana bisetata</i>	Waldo gentian	GEBI2
Gentianaceae	<i>Gentiana newberryi</i>	Newberry's gentian	GENE
Gentianaceae	<i>Gentiana pleurisetosa</i>		GEPL
Gentianaceae	<i>Gentiana setigera</i>	elegant gentian	GESE
Gentianaceae	<i>Gentiana simplex</i>	one-flowered gentian	GESI
Rosaceae	<i>Geum macrophyllum</i>	Oregon avens	GEMA
Polemoniaceae	<i>Gilia aggregata</i>	scarlet gilia	GIAG
Polemoniaceae	<i>Gilia capitata</i>	bluefield gilia	GICA
Orchidaceae	<i>Goodyera oblongifolia</i>	rattlesnake-plantain	GOOB
Orchidaceae	<i>Habenaria dilatata</i>	white bog-orchid	HADI2
Orchidaceae	<i>Habenaria elegans</i>	elegant bog-orchid	HAEL
Orchidaceae	<i>Habenaria unalascensis</i>	Alaska bog-orchid	HAUN
Boraginaceae	<i>Hackelia deflexa</i>	nodding stickseed	HADE
Compositae	<i>Haplopappus arborescens</i>	golden fleece	HAAR2
Compositae	<i>Haplopappus carthamoides</i>	large-flowered goldenweed	HACA
Compositae	<i>Haplopappus racemosus congestus</i>	racemed goldenweed	HARAC
Compositae	<i>Haplopappus whitneyi discoideus</i>	Whitney's haplopappus	HAWHL
Liliaceae	<i>Hastingsia bracteosa</i>	large flowered rush lily	HABR
Ericaceae	<i>Hemitomes congestum</i>	gnome-plant	HECO
Umbelliferae	<i>Heracleum lanatum</i>	common cowparsnip	HELA
Saxifragaceae	<i>Heuchera micrantha</i>	smallflower alumroot	HEMI
Compositae	<i>Hieracium albiflorum</i>	white-flowered hawkweed	HAL
Compositae	<i>Hieracium bolanderi</i>	Bolander's hawkweed	HIBO
Compositae	<i>Hieracium greenei</i>	Green's hawkweed	HIGR2
Compositae	<i>Hieracium parryi</i>	Parry's hawkweed	HIPA
Gramineae	<i>Hierochloa occidentalis</i>	California sweetgrass	HIOC
Gramineae	<i>Holcus lanatus</i>	commom velvet-grass	HOLA
Rosaceae	<i>Holodiscus discolor</i>	creambush ocean-spray	HODI
Rosaceae	<i>Horkelia hendersonii</i>	Henderson's horkelia	HOHE
Rosaceae	<i>Horkelia sericata</i>	silky horkelia	HOSE
Umbelliferae	<i>Hydrocotyle verticillata</i>	whorled water pennywort	HYVE
Hydrophyllaceae	<i>Hydrophyllum capitatum</i>	ball   eadwaterleaf	HYCA
Hydrophyllaceae	<i>Hydrophyllum capitatum alpinum</i>	alpine waterleaf	HYCAA
Hydrophyllaceae	<i>Hydrophyllum capitatum capitatum</i>	dwarf waterleaf	HYCAC
Hydrophyllaceae	<i>Hydrophyllum fendleri albifrons</i>	Fendler's waterleaf	HYFEA
Hydrophyllaceae	<i>Hydrophyllum occidentale</i>	California waterleaf	HYOC
Hydrophyllaceae	<i>Hydrophyllum tenuipes</i>	Pacific waterleaf	HYTE
Hypericaceae	<i>Hypericum perforatum</i>	Klamath weed	HYPE
Ericaceae	<i>Hypopitys monotropa</i>	fringed pinesap	HYMO
Malvaceae	<i>Iliamna latibracteata</i>	broad-bracted globemallow	ILLA
Iridaceae	<i>Iris bracteata</i>	Siskiyou iris	IRBR
Iridaceae	<i>Iris chrysophylla</i>	slender-tubed iris	IRCH
Iridaceae	<i>Iris innominata</i>	golden iris	IRIN
Iridaceae	<i>Iris tenax</i>	Oregon iris	IRTE

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Iridaceae	<i>Iris tenax klamathensis</i>	Klamath iris	IRTEK
Juncaceae	<i>Juncus parryi</i>	Parry's rush	JUPA
Juncaceae	<i>Juncus regelii</i>	Regel's rush	JURE
Juncaceae	<i>Juncus supiniiformis</i>	spreading rush	JUSU
Juncaceae	<i>Juncus tenuis dudleyi</i>	slender rush	JUTED
Cupressaceae	<i>Juniperus communis</i>	common juniper	JUCO4
Cupressaceae	<i>Juniperus communis jackii</i>	Del Norte juniper	JUCOJ
Ericaceae	<i>Kalmiopsis leachiana</i>	kalmiopsis	KALE
Gramineae	<i>Koeleria cristata</i>	prairie Junegrass	KOCR
Compositae	<i>Lasthenia macrantha prisca</i>	perennial baeria	LAMAP
Leguminosae	<i>Lathyrus delnorticus</i>	Del Norte pea	LADE
Leguminosae	<i>Lathyrus polyphyllus</i>	leafy peavine	LAPO
Cruciferae	<i>Lepidium latifolium</i>	pepperwort	LELA
Polemoniaceae	<i>Leptodactylon hazelae</i>	Hazel's shrubby gilia	LEHA
Cruciferae	<i>Lesquerella kingii</i>		
	<i>diversifolia</i>	King's bladderpod	LEKID
Ericaceae	<i>Leucothoe davisiae</i>	Sierra-laurel	LEDA
Portulacaceae	<i>Lewisia cotyledon howellii</i>	Howell's lewisia	LECOH
Portulacaceae	<i>Lewisia cotyledon purdyi</i>	Purdy's lewisia	LECOP
Portulacaceae	<i>Lewisia leana</i>	many-flowered lewisia	LELE
Portulacaceae	<i>Lewisia oppositifolia</i>	opposite-leaved lewisia	LEOP
Portulacaceae	<i>Lewisia triphylla</i>	threeleaf lewisia	LETR
Umbelliferae	<i>Ligusticum apiifolium</i>	parsley-leaved licorice-root	LIAP
Umbelliferae	<i>Ligusticum grayi</i>	Gray's licorice-root	LIGR
Liliaceae	<i>Lilium bolanderi</i>	Howell's lily	LIBO3
Liliaceae	<i>Lilium columbianum</i>	tiger lily	LICO4
Liliaceae	<i>Lilium kelloggii</i>	Kellogg's lily	LIKE
Liliaceae	<i>Lilium occidentale</i>	Eureka lily	LIOC
Liliaceae	<i>Lilium parvum</i>	small tiger lily	LIPA3
Liliaceae	<i>Lilium rubescens</i>	lilac lily	LIRU2
Liliaceae	<i>Lilium vollmeri</i>	vollmeri lily	LIVO
Liliaceae	<i>Lilium washingtonianum</i>	Washington lily	LIWA
Liliaceae	<i>Lilium wigginsii</i>	Wiggin's lily	LIWI
Limnanthaceae	<i>Limnantes gracilis gracilis</i>	slender meadow-foam	LIGRG
Caprifoliaceae	<i>Linnaea borealis longiflora</i>	western twinflower	LIBOL
Linaceae	<i>Linum perenne lewisii</i>	wild blue flax	LIPEL
Orchidaceae	<i>Listera caurina</i>	northwest listera	LICA3
Orchidaceae	<i>Listera cordata</i>	northern listera	LICO3
Fagaceae	<i>Lithocarpus densiflora</i>	tanoak	LIDE3
Saxifragaceae	<i>Lithophragma campanulata</i>		LICA6
Saxifragaceae	<i>Lithophragma parviflora</i>	smallflower fringe-cup	LIPA
Umbelliferae	<i>Lomatium engelmanni</i>	Engelmann's biscuit-root	LOEN
Umbelliferae	<i>Lomatium howellii</i>	Howells' biscuit-root	LOHO
Umbelliferae	<i>Lomatium martindalei</i>	few-fruited biscuit-root	LOMA2
Umbelliferae	<i>Lomatium nelsonianum</i>	Nelson's biscuit-root	LONE3
Umbelliferae	<i>Lomatium tracyi</i>	Tracy's biscuit-root	LOTR2
Umbelliferae	<i>Lomatium triternatum</i>	nine-leaf biscuit-root	LOTR
Umbelliferae	<i>Lomatium triternatum</i>		
	<i>triternatum</i>	nine-leaf biscuit-root	LOTRT
Umbelliferae	<i>Lomatium utriculatum</i>	fineleaf biscuit-root	LOUT

Family	Scientific name	Common name	Code
Caprifoliaceae	<i>Lonicera ciliosa</i>	trumpet honeysuckle	LOCI
Caprifoliaceae	<i>Lonicera conjugialis</i>	purple-flower honeysuckle	LOCO
Caprifoliaceae	<i>Lonicera hispidula</i>	hairy honeysuckle	LOHI
Leguminosae	<i>Lotus crassifolius</i>	big deervetch	LOCR
Leguminosae	<i>Lotus micranthus</i>	small-flowered deervetch	LOMI
Leguminosae	<i>Lupinus albicaulis</i>	sickle-keeled lupine	LUAL
Leguminosae	<i>Lupinus albilfrons</i>	white-leaved lupine	LUAL2
Leguminosae	<i>Lupinus aridus ashlandensis</i>	Ashland lupine	LUARA
Leguminosae	<i>Lupinus bicolor</i>	two-colored lupine	LUBI
Leguminosae	<i>Lupinus caudatus</i>	tailcup lupine	LUCA
Leguminosae	<i>Lupinus croceus pilosellus</i>	saffron-flowered lupine	LUCRP
Leguminosae	<i>Lupinus lapidicola</i>	Mt. Eddy lupine	LULA3
Leguminosae	<i>Lupinus latifolius</i>	broadleaf lupine	LULA
Leguminosae	<i>Lupinus leucophyllus</i>	velvet lupine	LULE
Leguminosae	<i>Lupinus polyphyllus pallidipes</i>	bingleaf lupine	LUPOF
Leguminosae	<i>Lupinus tracyi</i>	Tracy's lupine	LUTR
Juncaceae	<i>Luzula campestris</i>	field woodrush	LUCA2
Juncaceae	<i>Luzula hitchcockii</i>	smooth woodrush	LUHI
Juncaceae	<i>Luzula parviflora</i>	smallflowered woodrush	LUPA
Lycopodiaceae	<i>Lycopodium inundatum</i>	bog clubmoss	LYIN
Labiatae	<i>Lycopus uniflorus</i>	northern bugleweed	LYUN
Araceae	<i>Lysichitum americanum</i>	yellow skunk cabbage	LYAM
Compositae	<i>Madia elegans</i>	showy tarweed	MAEL
Compositae	<i>Madia madioides</i>	woodland tarweed	MAMA
Cucurbitaceae	<i>Marah oreganus</i>	Oregon bigroot	MAOR
Papaveraceae	<i>Meconella californica</i>	narrow-leaved meconella	MECA3
Papaveraceae	<i>Meconella oregana</i>	white meconella	MEOR
Gramineae	<i>Melica aristata</i>	bearded melic	MEAR
Gramineae	<i>Melica geyeri</i>	Geyer's oniongrass	MEGE
Gramineae	<i>Melica harfordii</i>	Harford's melic	MEHA
Gramineae	<i>Melica subulata</i>	Alaska oniongrass	MESU
Labiatae	<i>Melissa officinalis</i>	garden balm	MEOF2
Ericaceae	<i>Menziesia ferruginea</i>	mock azalea	MEFE
Boraginaceae	<i>Mertensia bella</i>	Oregon bluebells	MEBE
Boraginaceae	<i>Mertensia campanulata</i>	Idaho bluebells	MECA2
Boraginaceae	<i>Mertensia ciliata</i>	ciliate bluebells	MECI
Boraginaceae	<i>Mertensia paniculata</i>	tall bluebells	MEPA
Boraginaceae	<i>Mertensia platyphylla</i>	broadleaved bluebells	MEPL
Compositae	<i>Microseris bigelovii</i>	coast microseris	MIBI
Compositae	<i>Microseris howellii</i>	Howell's microseris	MIHO
Compositae	<i>Microseris nutans siskiyouensis</i>	Siskiyou microseris	MINUS
Scrophulariaceae	<i>Mimulus alsinoides</i>	chickweed monkey-flower	MIAL
Scrophulariaceae	<i>Mimulus douglasii</i>	Douglas's monkey-flower	MIDO
Scrophulariaceae	<i>Mimulus guttatus</i>	yellow monkey-flower	MIGU
Scrophulariaceae	<i>Mimulus jepsonii</i>	Jepson's monkey-flower	MIJE
Scrophulariaceae	<i>Mimulus kelloggii</i>	Kellogg's monkey-flower	MIKE
Scrophulariaceae	<i>Mimulus pulsiferae</i>	Pulsifer's monkey-flower	MIPU
Scrophulariaceae	<i>Mimulus pygmaeus</i>	short-stemmed monkey-flower	MIPY

Family	Scientific name	Common name	Code
Scrophulariaceae	Mimulus suksdorfii	Suksdorf's monkey-flower	MISU
Scrophulariaceae	Mimulus tricolor	tricolored monkey-flower	MITR3
Nyctaginaceae	Mirabilis greenei	Siskiyou four-o'clock	MIGR2
Saxifragaceae	Mitella breweri	Brewer's mitrewort	MIBR
Saxifragaceae	Mitella pentandra	alpine mitrewort	MIPE
Saxifragaceae	Mitella trifida	three-tooth mitrewort	MITR2
Labiatae	Monardella odoratissima	mountain balm	MOOD
Labiatae	Monardella purpurea	Siskiyou monardella	MOPU2
Ericaceae	Monotropa hypopitys	pinemap	MOHY
Ericaceae	Monotropa uniflora	Indian-pipe	MOUN2
Portulacaceae	Montia dichotoma	dwarf montia	MODI
Portulacaceae	Montia diffusa	branching montia	MODI3
Portulacaceae	Montia parvifolia	littleleaf montia	MOPA
Portulacaceae	Montia perfoliata	miner's lettuce	MOPE
Portulacaceae	Montia perfoliata depressa	red montia	MOPED
Portulacaceae	Montia sibirica	candyflower	MOSI
Portulacaceae	Montia sibirica bulbifera	western springbeauty	MOSIB
Portulacaceae	Montia sibirica sibirica	Siberian montia	MOSIS
Portulacaceae	Montia spathulata	pale montia	MOSP
Hydrophyllaceae	Nama lobbii	Lobb's nama	NALO
Polemoniaceae	Navarretia intertexta	needle-leaf navarretia	NAIN
Hydrophyllaceae	Nemophila heterophylla	small white nemophila	NEHE
Hydrophyllaceae	Nemophila parviflora	small-flowered nemophila	NEPA
Scrophulariaceae	Nothochelone nemorosa	woodland beard-tongue	NONE
Rosaceae	Oemelaria cerasiformis	Indian plum	OECE
Onagraceae	Oenothera wolfii	Wolf's evening-primrose	OEWO
Orobanchaceae	Orobanche fasciculata	clustered broomrape	ORFA2
Orobanchaceae	Orobanche pinorum	pine broomrape	ORPI
Orobanchaceae	Orobanche uniflora	naked broomrape	ORUN
Scrophulariaceae	Orthocarpus copelandii		
	cryptanthus	Copeland's owl-clover	ORCOC
Scrophulariaceae	Orthocarpus cuspidatus	broad scaled owl-clover	ORCU
Scrophulariaceae	Orthocarpus hispidus	hairy owl-clover	ORHI
Scrophulariaceae	Orthocarpus imbricatus	mountain owl-clover	ORIM
Scrophulariaceae	Orthocarpus pusillus	dwarf owl-clover	ORPU
Umbelliferae	Osmorhiza chilensis	mountain sweet-root	OSCH
Umbelliferae	Osmorhiza occidentalis	western sweet-root	OSOC
Umbelliferae	Osmorhiza purpurea	purple sweet-root	OSPU
Oxalidaceae	Oxalis oregana	Oregon oxalis	OXOR
Oxalidaceae	Oxalis suksdorfii	western yellow oxalis	OXSU
Oxalidaceae	Oxalis trilliifolia	great oxalis	OXTR
Celastraceae	Pachistima myrsinites	Oregon boxwood	PAMY
Scrophulariaceae	Pedicularis bracteosa	bracted lousewort	PEBR
Scrophulariaceae	Pedicularis flavida	Klamath lousewort	PEFL2
Scrophulariaceae	Pedicularis howellii	Howell's pedicularis	PEHO
Scrophulariaceae	Pedicularis racemosa	leafy lousewort	PERA
Polypodiaceae	Pellaea andromedaefolia	coffee fern	PEAN
Polypodiaceae	Pellaea brachyptera	Sierra cliff brake	PEBR2
Scrophulariaceae	Penstemon azureus	azure penstemon	PEAZ
Scrophulariaceae	Penstemon cardwellii	Cardwell's penstemon	PECA3

Family	Scientific name	Common name	Code
Scrophulariaceae	<i>Penstemon deustus</i>	hot-rock penstemon	PEDE
Scrophulariaceae	<i>Penstemon newberryi</i>	Newberry's penstemon	PENE
Scrophulariaceae	<i>Penstemon ovatus</i>	broad-leaved penstemon	PEOV
Scrophulariaceae	<i>Penstemon parvulus</i>	parvulus penstemon	PEPA3
Scrophulariaceae	<i>Penstemon speciosus</i>	royal pentemon	PESP
Scrophulariaceae	<i>Penstemon wilcoxii</i>	Wilcox's penstemon	PEWI
Umbelliferae	<i>Perideridia bolanderi</i>	Bolander's yampah	PEBO
Umbelliferae	<i>Perideridia erythrorhiza</i>	red-rooted yampah	PEER2
Umbelliferae	<i>Perideridia howellii</i>	Howell's yampah	PEHO2
Umbelliferae	<i>Perideridia leptocarpa</i>	narrow-fruited yampah	PELE2
Umbelliferae	<i>Perideridia oregana</i>	Oregon yampah	PEOR2
Compositae	<i>Petasites frigidus</i>	sweet coltsfoot	PEFR2
Hydrophyllaceae	<i>Phacelia argentea</i>	silvery phacelia	PHAR2
Hydrophyllaceae	<i>Phacelia capitata</i>	phacelia	PHCA5
Hydrophyllaceae	<i>Phacelia corymbosa</i>	phacelia	PHCO3
Hydrophyllaceae	<i>Phacelia hastata</i>	whiteleaf phacelia	PHHA
Hydrophyllaceae	<i>Phacelia heterophylla</i>	varileaf phacelia	PHHE
Hydrophyllaceae	<i>Phacelia pseudohispida</i>	varileaf phacelia	PHHEP
Hydrophyllaceae	<i>Phacelia leonis</i>	Leon's phacelia	PHLE3
Hydrophyllaceae	<i>Phacelia malvaefolia</i>	mallow-leaved phacelia	PHMA2
Hydrophyllaceae	<i>Phacelia nemoralis</i>	woodland phacelia	PHNE
Hydrophyllaceae	<i>Phacelia verna</i>	spring phacelia	PHVE
Hydrangeaceae	<i>Philadelphus lewisii</i>	Lewis' mockorange	PHLE2
Gramineae	<i>Phleum pratense</i>	common timothy	PHPR
Polemoniaceae	<i>Phlox adsurgens</i>	woodland phlox	PHAD
Polemoniaceae	<i>Phlox diffusa</i>	spreading phlox	PHDI
Polemoniaceae	<i>Phlox hirsuta</i>	Stansbury's phlox	PHHI
Polemoniaceae	<i>Phlox speciosa</i>	showy phlox	PHSP
Rosaceae	<i>Physocarpus capitatus</i>	Pacific ninebark	PHCA3
Pinaceae	<i>Picea breweriana</i>	Brewer spruce	PIBR
Pinaceae	<i>Picea engelmannii</i>	Engelmann spruce	PIEN
Lentibulariaceae	<i>Pinguicula macroceras</i>	butterwort	PEMA
Pinaceae	<i>Pinus attenuata</i>	knobcone pine	PIAT
Pinaceae	<i>Pinus contorta</i>	lodgepole pine	PICO
Pinaceae	<i>Pinus jefferyi</i>	Jeffrey pine	PIJE
Pinaceae	<i>Pinus lambertiana</i>	sugar pine	PILA
Pinaceae	<i>Pinus monticola</i>	western white pine	PIMO
Pinaceae	<i>Pinus ponderosa</i>	ponderosa pine	PIPO
Ericaceae	<i>Pityopus californica</i>	pine-foot	PICA
Boraginaceae	<i>Plagiobothrys figuratus</i>	fragrant popcorn-flower	PLFI
Boraginaceae	<i>Plagiobothrys hirtus</i>		
	<i>corallicarpus</i>	rough popcorn-flower	PLHIC
Boraginaceae	<i>Plagiobothrys lamprocarpus</i>	shiny fruited popcorn-flower	PLLA2
Boraginaceae	<i>Plagiobothrys nothofulvus</i>	rusty popcorn-flower	PLNO
Ericaceae	<i>Pleuricospora fimbriolata</i>	Sierra-sap	PLFI2
Gramineae	<i>Pleuropogon refractus</i>	nodding semaphoregrass	PLRE
Gramineae	<i>Poa bulbosa</i>	bulbous bluegrass	POBU
Gramineae	<i>Poa laxiflora</i>	loose-flowered bluegrass	POLA2
Gramineae	<i>Poa leibergii</i>	Leiberg's bluegrass	POLE2



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Gramineae	<i>Poa palustris</i>	fowl bluegrass	POPA
Gramineae	<i>Poa pattersonii</i>	Patterson's bluegrass	POPA7
Gramineae	<i>Poa piperi</i>	timber bluegrass	POPI
Gramineae	<i>Poa pratensis</i>	Kentucky bluegrass	POPR
Gramineae	<i>Poa sandbergii</i>	Sandberg's bluegrass	POSA3
Gramineae	<i>Poa scabrella</i>	pine bluegrass	POSC
Polemoniaceae	<i>Polemonium carneum</i>	great polemonium	POCA2
Polemoniaceae	<i>Polemonium chartaceum</i>	Mason's sky pilot	POCH
Polemoniaceae	<i>Polemonium pulcherrimum</i>	skunk-leaved polemonium	POPU
Polygalaceae	<i>Polygala californica</i>	California milkwort	POCA8
Polygonaceae	<i>Polygonum bistortoides</i>	American bistort	POBI
Polygonaceae	<i>Polygonum cascadenae</i>	Cascadian knotweed	POCA5
Polygonaceae	<i>Polygonum heterosepalum</i>	dwarf desert knotweed	POHE
Polygonaceae	<i>Polygonum phytolaccaefolium</i>	alpine knotweed	POPH
Polygonaceae	<i>Polygonum scandens</i>	hedge cornbind	POSC2
Polypodiaceae	<i>Polypodium glycyrrhiza</i>	licorice-fern	POGL4
Polypodiaceae	<i>Polypodium hesperium</i>	Columbia fern	POHE2
Polypodiaceae	<i>Polystichum californicum</i>	California sword-fern	POCA7
Polypodiaceae	<i>Polystichum lemmonii</i>	Shasta fern	POLE4
Polypodiaceae	<i>Polystichum mohrioides</i>	Shasta fern	POMO3
Polypodiaceae	<i>Polystichum munitum</i>	western sword-fern	POMU
Polypodiaceae	<i>Polystichum munitum</i>	imbricate sword-fern	POMUI
Polypodiaceae	<i>Polystichum munitum munitum</i>	sword-fern	POMUM
Rosaceae	<i>Potentilla glandulosa</i>	sticky cinquefoil	POGL
Rosaceae	<i>Potentilla glandulosa</i>		
	<i>glandulosa</i>	gland cinquefoil	POGLG
Rosaceae	<i>Potentilla glandulosa</i>		
	<i>globosa</i>	globe cinquefoil	POGLG2
Rosaceae	<i>Potentilla glandulosa</i>		
	<i>nevadensis</i>	Nevada cinquefoil	POGLN
Rosaceae	<i>Potentilla gracilis</i>	northwest cinquefoil	POGR
Rosaceae	<i>Potentilla quinquefolia</i>	snow cinquefoil	POQU
Labiatae	<i>Prunella vulgaris</i>	self-heal	PRVU
Rosaceae	<i>Prunus emarginata</i>	bittercherry	PREM
Rosaceae	<i>Prunus virginiana</i>	common chokecherry	PRVI
Pinaceae	<i>Pseudotsuga menziesii</i>	Douglas-fir	PSME
Leguminosae	<i>Psoralea physodes</i>	California-tea	PSPH
Polypodiaceae	<i>Pteridium aquilinum</i>	braken	PTAQ
Ericaceae	<i>Pterospora andromedea</i>	woodland pinedrops	PTAN
Rosaceae	<i>Purshia tridentata</i>	bitter-brush	PUTR
Ericaceae	<i>Pyrola asphylla</i>	leafless pyrola	PYAP
Ericaceae	<i>Pyrola asarifolia</i>	alpine pyrola	PYAS
Ericaceae	<i>Pyrola asarifolia purpurea</i>	liver-leaf pyrola	PYASP
Ericaceae	<i>Pyrola dentata</i>	toothleaf pyrola	PYDE
Ericaceae	<i>Pyrola picta</i>	whitevein pyrola	PYPI
Ericaceae	<i>Pyrola secunda</i>	one-sided pyrola	PYSE
Fagaceae	<i>Quercus chrysolepis</i>	canyon live oak	QUCH
Fagaceae	<i>Quercus garryana</i>	Oregon oak	QUGA
Fagaceae	<i>Quercus kelloggii</i>	California black oak	QUKE

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Fagaceae	Quercus sadleriana	Sadler oak	QUSA
Fagaceae	Quercus vaccinifolia	huckleberry oak	QUVA
Ranunculaceae	Ranunculus alismaefolius alismellus	plaintainleaved buttercup	RAALA
Ranunculaceae	Ranunculus occidentalis	western buttercup	RAOC
Ranunculaceae	Ranunculus occidentalis occidentalis	western buttercup	RAOCO
Rhamnaceae	Rhamnus californica	coffeeberry	RHCA
Rhamnaceae	Rhamnus purshiana	cascara	RHPU
Ericaceae	Rhododendron macrophyllum	Pacific rhododendron	RHMA
Ericaceae	Rhododendron occidentale	western azalea	RHOC
Anacardiaceae	Rhus diversiloba	poison oak	RHDI
Grossulariaceae	Ribes binominatum	Siskiyou gooseberry	RIBI
Grossulariaceae	Ribes cereum	squaw currant	RICE
Grossulariaceae	Ribes cruentum	shinyleaf gooseberry	RICR
Grossulariaceae	Ribes erythrocarpum	CraterLake currant	RIER
Grossulariaceae	Ribes lacustre	swamp gooseberry	RILA
Grossulariaceae	Ribes laxiflorum	western currant	RILA2
Grossulariaceae	Ribes lobbii	gummy gooseberry	RILO
Grossulariaceae	Ribes marshallii	Applegate gooseberry	RIMA
Grossulariaceae	Ribes menziesii	prickly gooseberry	RIME
Grossulariaceae	Ribes sanguineum	red currant	RISA
Grossulariaceae	Ribes velutinum	desert gooseberry	RIVE
Grossulariaceae	Ribes viscosissimum	sticky currant	RIVI
Rosaceae	Rosa gymnocarpa	baldhip rose	ROGY
Rosaceae	Rubus lasiococcus	dwarf bramble	RULA
Rosaceae	Rubus leucodermis	black raspberry	RULE
Rosaceae	Rubus nivalis	snow bramble	RUNI
Rosaceae	Rubus parviflorus	thimbleberry	RUPA
Rosaceae	Rubus spectabilis	salmonberry	RUSP
Rosaceae	Rubus ursinus	Pacific blackberry	RUUR
Compositae	Rudbeckia occidentalis occidentalis	black-headed coneflower	RUOCO
Polygonaceae	Rumex acetosella	sheep sorrel	RUAC
Polygonaceae	Rumex occidentalis	western dock	RUOC2
Salicaceae	Salix delnortensis	Del Norte willow	SADE2
Salicaceae	Salix tracyi	Tracy's willow	SATR2
Caprifoliaceae	Sambucus cerulea	blue elderberry	SACE
Caprifoliaceae	Sambucus racemosa	red elderberry	SARA
Umbelliferae	Sanicula graveolens	Sierra sanicle	SAGR
Umbelliferae	Sanicula peckiana	Peck's sanicle	SAPE4
Umbelliferae	Sanicula tracyi	Tracy's sanicle	SATR
Umbelliferae	Sanicula tuberosa	turkey pea	SATU
Pyrolaceae	Sarcodes sanguinea	snow plant	SASA2
Labiatae	Satureja douglasii	yerba buena	SADO
Compositae	Saussurea americana	American sawwort	SAAM
Saxifragaceae	Saxifraga fragarioides	strawberry saxifrage	SAFR2
Saxifragaceae	Saxifraga howellii	Howell's saxifrage	SAHO2
Saxifragaceae	Saxifraga mertensiana	wood saxifrage	SAME3
Saxifragaceae	Saxifraga oregana	bogsaxifrage	SAOR

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Umbelliferae	Scandix pecten-veneris	Venus'-comb	SCPE
Liliaceae	Schoenolirion album	white flower rush lily	SCAL
Cyperaceae	Scirpus fluviatilis	river bulrush	SCFL
Cyperaceae	Scirpus subterminalis	water clubrush	SCSU
Crassulaceae	Sedum lanceolatum	lanceleaved stonecrop	SELA2
Crassulaceae	Sedum laxum heckneri	Heckner's stonecrop	SELAH
Crassulaceae	Sedum laxum laxum	lax stonecrop	SELAL
Crassulaceae	Sedum moranii	glandular stonecrop	SEMO
Crassulaceae	Sedum oblancoelatum		SEOB
Crassulaceae	Sedum oreganum	Oregon stonecrop	SEOR2
Crassulaceae	Sedum purdyi	Purdy's stonecrop	SEPU
Crassulaceae	Sedum spathulifolium	spatula-leaf stonecrop	SESP
Compositae	Senecio bolanderi	Bolander's groundsel	SEBO
Compositae	Senecio hesperius		SEHE
Compositae	Senecio integerrimus	western groundsel	SEIN
Compositae	Senecio ligulifolius		SELI
Compositae	Senecio triangularis	arrowleaf groundsel	SETR
Taxodiaceae	Sequoia sempervirens	coast redwood	SESE2
Malvaceae	Sidalcea cusickii	Cusick's checker-mallow	SICU
Malvaceae	Sidalcea malachroides	maple-leaved checker-mallow	SIMA4
Malvaceae	Sidalcea malvaeflora nana	dwarf checker-mallow	SIMAN
Malvaceae	Sidalcea malvaeflora patula		SIMAP
Malvaceae	Sidalcea setosa querceta		SISEQ
Malvaceae	Sidalcea setosa setosa	bristly checker-mallow	SISES
Caryophyllaceae	Silene campanulata	slender campion	SICA2
Caryophyllaceae	Silene campanulata glandulosa	gland campion	SICAG
Caryophyllaceae	Silene grayi	Gray's silene	SIGR
Caryophyllaceae	Silene hookeri	Hooker's silene	SIHO
Caryophyllaceae	Silene hookeri bolanderi	Bolander's pink	SIHOB
Caryophyllaceae	Silene hookeri pulverulenta	dusty pink	SIHOP
Gramineae	Sitanion hystrix	bottlebrush squirreltail	SIHY
Cruciferae	Smelowskia calycina	alpine smelowskia	SMCA
Liliaceae	Smilacina racemosa	western false Solomon's-seal	SMRA
Liliaceae	Smilacina stellata	starry false Solomon's-seal	SMST
Liliaceae	Smilax jamesii	English Peak greenbrier	SMJA
Leguminosae	Sophora leachiana	western sophora	SOLE
Rosaceae	Sorbus sitchensis	Sitka mountain-ash	SOSI
Rosaceae	Spiraea douglasii	Douglas' spirea	SPDO
Portulacaceae	Spraguea umbellata	pussypaws	SPUM
Labiatae	Stachys mexicana	great hedge-nettle	STME2
Labiatae	Stachys rigida	rigid hedge-nettle	STRI
Gramineae	Stipa lemmonii	Lemmon's needlegrass	STLE2
Gramineae	Stipa lettermanii	Letterman's needlegrass	STLE
Gramineae	Stipa occidentalis	western needlegrass	STOC
Gramineae	Stipa occidentalis minor	small needlegrass	STOCM
Streptanthus	Streptanthus howellii	Howell's streptanthus	STHO
Liliaceae	Streptopus amplexifolius	clasping-leaf twisted-stalk	STAM
Liliaceae	Streptopus roseus	rosy twisted-stalk	STRO
Saxifragaceae	Suksdorfia ranunculifolia	buttercupleaved suksdorfia	SURA

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Caprifoliaceae	<i>Symphoricarpos albus</i>	common snowberry	SYAL
Caprifoliaceae	<i>Symphoricarpos mollis</i>	creeping snowberry	SYMO
Scrophulariaceae	<i>Synthyris reniformis</i>	snow-queen	SYRE
Compositae	<i>Tanacetum douglasii</i>	western tansy	TADO
Umbelliferae	<i>Tauschia glauca</i>	glaucous tauschia	TAGL
Umbelliferae	<i>Tauschia howellii</i>	Howell's tauschia	TAHO2
Taxaceae	<i>Taxus brevifolia</i>	Pacific yew	TABR
Saxifragaceae	<i>Tellima grandiflora</i>	Alaska fringe-cup	TEGR
Leguminosae	<i>Thermopsis montana</i>	mountain thermopsis	THMO
Cruciferae	<i>Thlaspi fendleri</i>	Fendler's pennycress	THFE
Cruciferae	<i>Thlaspi fendleri glaucum</i>	Fendler's pennycress	THFEG
Cruciferae	<i>Thlaspi montanum siskiyouense</i>	Siskiyou pennycress	THMOS
Cupressaceae	<i>Thuja plicata</i>	western redcedar	THPL
Saxifragaceae	<i>Tiarella trifoliata</i>	foamflower	TITR
Saxifragaceae	<i>Tiarella trifoliata laciniata</i>	cutleaf foamflower	TITRL
Saxifragaceae	<i>Tiarella trifoliata trifoliata</i>	trefoil foamflower	TITRT
Saxifragaceae	<i>Tiarella trifoliata unifoliata</i>	coolwort foamflower	TITRU
Scrophulariaceae	<i>Tonella tenella</i>	small-flowered tonella	TOTE
Primulaceae	<i>Trientalis latifolia</i>	western starflower	TRLA2
Leguminosae	<i>Trifolium eriocephalum</i>	wooly-head clover	TRER
Leguminosae	<i>Trifolium longipes</i>	long-stalked clover	TRLO
Liliaceae	<i>Trillium albidum</i>		TRAL3
Liliaceae	<i>Trillium chloropetalum</i>	giant trillium	TRCH
Liliaceae	<i>Trillium kurabayashii</i>	Kurabayash's trillium	TRKU
Liliaceae	<i>Trillium ovatum</i>	white trillium	TROV
Liliaceae	<i>Trillium rivale</i>	Oregon trillium	TRRI
Gramineae	<i>Trisetum canescens</i>	tall trisetum	TRCA
Liliaceae	<i>Triteleia crocea crocea</i>	yellow triteleia	TRCRC
Pinaceae	<i>Tsuga heterophylla</i>	western hemlock	TSHE
Pinaceae	<i>Tsuga mertensiana</i>	mountain hemlock	TSME
Lauraceae	<i>Umbellularia californica</i>	California-laurel	UMCA
Urticaceae	<i>Urtica dioica lyallii</i>	northwest nettle	URDIL
Ericaceae	<i>Vaccinium membranaceum</i>	thin-leaved huckleberry	VAME
Ericaceae	<i>Vaccinium ovatum</i>	evergreen huckleberry	VAOV2
Ericaceae	<i>Vaccinium oxycoccus intermedium</i>	wild cranberry	VAOXI
Ericaceae	<i>Vaccinium parvifolium</i>	red huckleberry	VAPA
Ericaceae	<i>Vaccinium scoparium</i>	grouseberry	VASC
Ericaceae	<i>Vaccinium uliginosum</i>	bog blueberry	VAUL
Berberidaceae	<i>Vancouveria chrysantha</i>	yellow inside-out-flower	VACH
Berberidaceae	<i>Vancouveria hexandra</i>	white inside-out-flower	VAHE
Berberidaceae	<i>Vancouveria planipetala</i>	small-flowered inside-out-flower	VAPL
Liliaceae	<i>Veratrum californicum</i>	California false hellebore	VECA
Liliaceae	<i>Veratrum insolitum</i>	Siskiyou false hellebore	VEIN
Liliaceae	<i>Veratrum viride</i>	American false hellebore	VEVI

Family	Scientific name	Common name	Code
Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	VETH
Scrophulariaceae	<i>Veronica copelandii</i>	Copeland's speedwell	VECO
Scrophulariaceae	<i>Veronica cusickii</i>	Cusick's speedwell	VECU
Leguminosae	<i>Vicia americana</i>	American vetch	VIAM
Leguminosae	<i>Vicia americana villosa</i>	American vetch	VIAMV
Leguminosae	<i>Vicia sativa</i>	common vetch	VISA
Violaceae	<i>Viola adunca</i>	early blue violet	VIAD
Violaceae	<i>Viola bakeri</i>	Baker violet	VIBA
Violaceae	<i>Viola cuneata</i>	wedgeleaf violet	VICU
Violaceae	<i>Viola glabella</i>	stream violet	VIGL
Violaceae	<i>Viola hallii</i>	Hall's violet	VIHA
Violaceae	<i>Viola nuttallii</i>	Nuttall's violet	VINU
Violaceae	<i>Viola occidentalis</i>	western violet	VIOC
Violaceae	<i>Viola ocellata</i>	pinto violet	VIOC2
Violaceae	<i>Viola orbiculata</i>	round-leaved violet	VIOR2
Violaceae	<i>Viola purpurea</i>	goosefoot violet	VIPU
Violaceae	<i>Viola sempervirens</i>	redwoods violet	WISE
Violaceae	<i>Viola sheltonii</i>	Shelton's violet	VISH
Vitaceae	<i>Vitis californica</i>	California grape-vine	VICA3
Hydrangeaceae	<i>Whipplea modesta</i>	whipplevine	WHMO
Polypodiaceae	<i>Woodwardia fimbriata</i>	giant chain-fern	WOFI
Liliaceae	<i>Xerophyllum tenax</i>	common beargrass	XETE
Liliaceae	<i>Zigadenus venenosus</i>	deadly zigadenus	ZIVE

TABLE 1: Association Occurrence by Ranger District

	ASHLAND	BUTTE FALLS	PROSPECT	TILLER	DIAMOND LAKE	NORTH UMPQUA	COTTAGE GROVE
TSME-ABLA2/VASC TSME/VASC/Dep TSME/CHUM/LIBOL TSME-ABMAS/VAME TSME-ABAM/RHMA		+	+		+	+	+
PICO-TSME/CAPE5 PICO/ARNE/LUPIN ABMAS-CHNO ABMAS/VAME ABAM/VAME-RULA	+		+	-	+	+	
ABAM/ACCI/TITR ABAM-TSHE/CLUN TSHE-ABAM/VAME TSHE/VAME/LIBOL TSHE/RHMA/LIBOL		-	+	+	+	+	+
TSHE-ABCO/RHMA TSHE-TABR/RHMA TSHE-CADE3/GASH TSHE/GASH/LIBOL TSHE-PSME/GASH				+	+	+	+
TSHE/GASH-CHUM TSHE/GASH/HIAL TSHE/ACGL/LIBOL TSHE/BENE/LIBOL TSHE/BENE/ACTR		+	+	+	-	-	-
TSHE-ACMA/POMU TSHE/ACCI/RUNI TSHE-THPL/OXOR TSHE/ACCI/OXOR TSHE/GASH/OXOR				+		+	+
TSHE/BENE/OXOR TSHE-ALRU/POMU THPL/RHMA/LIBOL THPL/WHMO/ANDE			+	+	+	+	+

+ Most occurrences of the association are on the District(s) indicated.

- The association occurs on the District(s), but not as often as above.

	ASHLAND	BUTTE FALLS	PROSPECT	TILLER	DIAMOND LAKE	NORTH UMPQUA	COTTAGE GROVE
ABCO-PICO/AMAL ABCO-TSME/VAME ABCO-ABMAS/CHUM ABCO-ABAM/BENE ABCO-TSHE/ACCI	+	+	+		+		
ABCO/RUN/ACTR ABCO/VAME/ACTR ABCO/VAME/LIBOL ABCO/ACCI/ACTR ABCO/BENE-GASH	- +		+	- +	+	+	
ABCO/ACGL/BENE ABCO/AMAL/ANDE ABCO/BENE/ANDE ABCO/CHUM/PYROLA ABCO/COCOC-AMAL	+	+					
ABCO/RHDI ABCO-CADE3/BENE ABCO-PSME/BEPI PSME/GASH/POMU PSME/BENE/POMU	- -	+	+	+	+	+	-
PSME/RHDI/PTAQ PSME/RHDI/CYGR PSME-QUGA/RHDI PSME-PIJE QUGA/FRVEB	+			+	+		